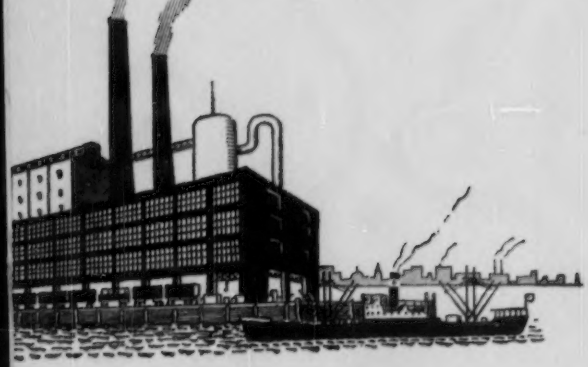
Vol. 31 No. 3
July 1955

ECONOMIC GEOGRAPHY



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ECONOMIC GEOGRAPHY

Editorial and Business Offices: 950 Main Street, Worcester, Mass.

Published Quarterly at
Commonwealth Press, 44 Portland Street, Worcester, Mass.

PRICE, $1.75 THE CURRENT NUMBER SIX DOLLARS A YEAR
(except for charter subscribers)

Entered as second class matter at the Post Office at Worcester, Mass.
under the Act of August 24, 1912

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THE FUTURE

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Mapping Cultural Groups in an American Industrial City . *Harold F. Creveling*

The American Centralizer Belt . . . . . *Loyal Durand, Jr.*

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ECONOMIC GEOGRAPHY

VOL. 31 JULY, 1955 No. 3

A SERVICE CLASSIFICATION OF AMERICAN CITIES*

Howard J. Nelson

Dr. Nelson, who is an Assistant Professor in the Department of Geography of the University of California at Los Angeles, specializes in Urban Geography.

EVERYONE is aware that modern cities are performing more and more of the services necessary to the functioning of society. There is an awareness, too, that these vital services are not performed in the same proportions by all cities. Almost every geographer would classify Detroit as a manufacturing city; Rochester, Minnesota, as a professional town; and Hartford, Connecticut, as an insurance center; thereby indicating that one city does more than its share of the nation's manufacturing, another provides professional services in outstanding proportions, and the third specializes in serving the insurance needs of society.

But perhaps this classification is done more by faith or intuition than on the basis of exact knowledge. At what point does an economic activity become important enough in a city to be of special significance? Can criteria be devised that will determine which cities should be labeled insurance centers, or retail trade cities, or centers of public administration? It is the purpose of this article to present a method that will form a basis for such a classification.

PROCEDURE

The best practical source of recent statistical data for a study involving a large number of American cities is the 1950 Census of Population. Here is available raw material gathered from every settlement in the United States, broken down in generous detail for urban places with populations of 10,000 or more. As we are interested in "geographic" or "functional" cities rather than political entities, "Urbanized Areas," which take in the entire built-up area, are used whenever available—where the Central City had at least 50,000 persons in 1940. (For example, the Los Angeles Urbanized Area is considered as one functional unit, instead of using the 45 political entities within it: Los Angeles, Pasadena, Long Beach, and so on, as 45 separate cities.) "Urban Places," mainly political cities but occasionally isolated unincorporated concentrations of population, are used for the smaller centers. After the "Urban Places" within "Urbanized Areas" are excluded to eliminate duplication, some 897 individual urban concentrations of over 10,000 persons remain for consideration.

The proportion of the labor force of a city engaged in performing a service is perhaps the best means of measuring the distribution of that activity. It is one of the few measures that are easily comparable from activity to activity or from year to year. Furthermore, the proportion of the labor

*This study was made possible by a Research Grant from the University of California.

force actually employed in a service is of much more direct significance to the economy of the city than the value or volume of sales of goods or of services performed, or similar measures for the manufactured products in a city.

The Census of Population breaks down the services performed by the labor force of a city into 24 major industry groups. These are listed in the first column of Table I. In considering the broad categories of services performed by urban areas for society, however, condensations and omissions seem called for. Agricultural workers, for example, who may simply reflect farm land within loosely drawn city limits, were omitted. So, arbitrarily, were the categories of utility and sanitary services, construction, and personal service in private households (though all other categories of personal service were included), on the grounds that these are not essentially services performed by urban areas for society as a whole. The following nine major categories of services were chosen for investigation in this study: Mining; Manufacturing; Transportation and Communication; Wholesale Trade; Retail Trade; Finance, Insurance and Real Estate; Personal Service; Professional Service; and Public Administration (see Table I).

After the nine categories indicated by Table I had been decided upon, the percentages of the total labor force in each activity group for each of the 897 cities were calculated. Table II illustrates the procedure for several selected cities. However, as individual percentages are almost meaningless without some point of reference, the arithmetic averages for each activity group were computed. The final column of Table II indicates the average percentage of those gainfully employed in various activity groups for the total of 897 cities.

TABLE I

MAJOR ECONOMIC ACTIVITIES

*Census Classification by Industry Groups**	*Service Classification*
Agriculture, forestry, and fisheries	Omitted
Mining	Mining
Construction	Omitted
Manufacturing	Manufacturing
Railroads and railway express service	
Trucking service and warehousing	Transportation and communication
Other transportation	
Telecommunications	
Utilities and sanitary services	Omitted
Wholesale trade	Wholesale trade
Food and dairy produce stores, and milk retail	
Eating and drinking places	Retail trade
Other retail trade	
Finance, insurance and real estate	Finance, insurance and real estate
Business services	
Repair services	Omitted
Private households	Omitted
Hotels and lodging places	
Other personal service	Personal service
Entertainment and recreation	
Medical and other health services	
Educational services, government	Professional service
Educational services, private	
Other professional and related services	
Public administration	Public administration
Industry not reported	Omitted

*U.S. Census of Population, 1950, Vol. 2, Table 35—Economic Characteristics of the Population. . . .

It is obvious from Table II that the average proportions of the labor force in each of the activity groups differ greatly. The performance of manufacturing service occupies the largest proportion of the labor force in the 897 American cities of 10,000 or more, 27.07 per cent. Another sizable fraction, nearly 20 per cent, is concerned with retail trade. Thus, over 45 out of every 100 workers in our cities are engaged in providing these two essential urban services—the fabrication of products and the distribution of goods at the retail level. The professional services necessary to society utilize about 11 per cent of the urban labor force—doctors, lawyers, teachers, engineers, and similar skills. The other six categories of urban services are performed by a relatively small fraction

TABLE II

Proportion of Labor Force in Selected Activities

Sample Cities

	New York		*Detroit*		*Kearney, Neb.*		*Rochester, Minn.*		*Average of 897 Cities*
	In 000's	*Per Cent*	*In 000's*	*Per Cent*	*In 000's*	*Per Cent*	*In 000's*	*Per Cent*	*Per Cent*
Population	12,296	.....	2,659	.....	12.11	.....	29.88	.....	.....
Labor force	6,099	.....	1,068	.....	3.28	.....	13.0	.....	.....
Manufacturing	1,573	25.8	501	46.9	0.27	8.3	0.81	6.1	27.07
Retail trade	822	13.5	164	15.3	1.18	36.2	2.72	20.7	19.09
Professional service	448	7.3	73	6.9	0.84	25.6	4.39	33.3	11.09
Transportation and comm.	475	7.8	71	6.7	0.32	9.7	0.73	6.3	7.12
Personal service	361	5.9	59	5.5	0.36	11.0	1.40	10.6	6.20
Public administration	227	3.7	36	3.4	0.20	6.1	0.41	3.1	4.58
Wholesale trade	274	4.5	33	3.1	0.22	6.6	0.42	3.1	3.85
Finance, insurance and real estate	353	5.8	36	3.4	0.13	3.9	0.39	2.9	3.19
Mining	3	0.05	0.3	0.01	0.005	0.15	0.01	0.09	1.62

Source: Census of Population: 1950, Vol. II, Table 35.

of urban workers. Transportation and communication account for 7.12 per cent; personal service, 6.2 per cent; public administration, 4.58 per cent; wholesale trade, 3.85 per cent; finance, insurance, and real estate, 3.19 per cent; and mining, 1.62 per cent.

Doubts might logically arise at this point—surely cities with variations in size of from 10,000 to 13,000,000 must vary considerably in the proportions of the labor force employed in the different services. How valid are averages taking in all of these differently sized cities? To shed some light on this question the 897 cities were broken down into seven arbitrarily selected groups by size as shown in Table III. This table indicates that though there is some correlation between size of city and the proportions of the labor force in each activity, no constant or regular change is in evidence. However, there is variation in some of the percentages and where they are small this may be quite significant. Generally speaking, the proportions of the labor force in retail trade, professional service, and mining vary inversely with city size, that is, the percentages decrease as the cities get larger. Most of the other activities seem to be performed in

TABLE III

Average Percentage of Those Gainfully Employed in Selected Activity Groups

	Manufacturing	*Retail*	*Professional Service*	*Wholesale*	*Personal Service*	*Public Adm.*	*Trans. and Comm.*	*Finance, Insurance Real Estate*	*Mining*	*No. of Cities*
In cities of from										
10,000 to 24,999	26.65	19.66	11.34	3.72	5.79	4.39	7.03	2.96	2.11	550
25,000 to 49,999	26.07	19.07	11.98	3.87	7.09	4.80	6.98	3.22	1.03	166
50,000 to 99,999	29.31	18.56	9.76	4.24	6.47	4.79	7.75	3.39	0.48	59
100,000 to 249,999	29.77	18.07	9.50	4.21	6.61	5.22	7.14	3.74	0.71	71
250,000 to 499,999	28.10	17.81	9.22	4.40	6.86	6.40	7.58	4.38	1.24	25
500,000 to 999,999	27.21	18.16	9.17	5.10	6.72	4.96	8.83	5.06	0.41	14
1,000,000 and over	30.86	16.32	8.97	4.15	6.42	6.92	7.35	4.75	0.16	12
Average	27.07	19.23	11.09	3.85	6.20	4.58	7.12	3.19	1.62	897

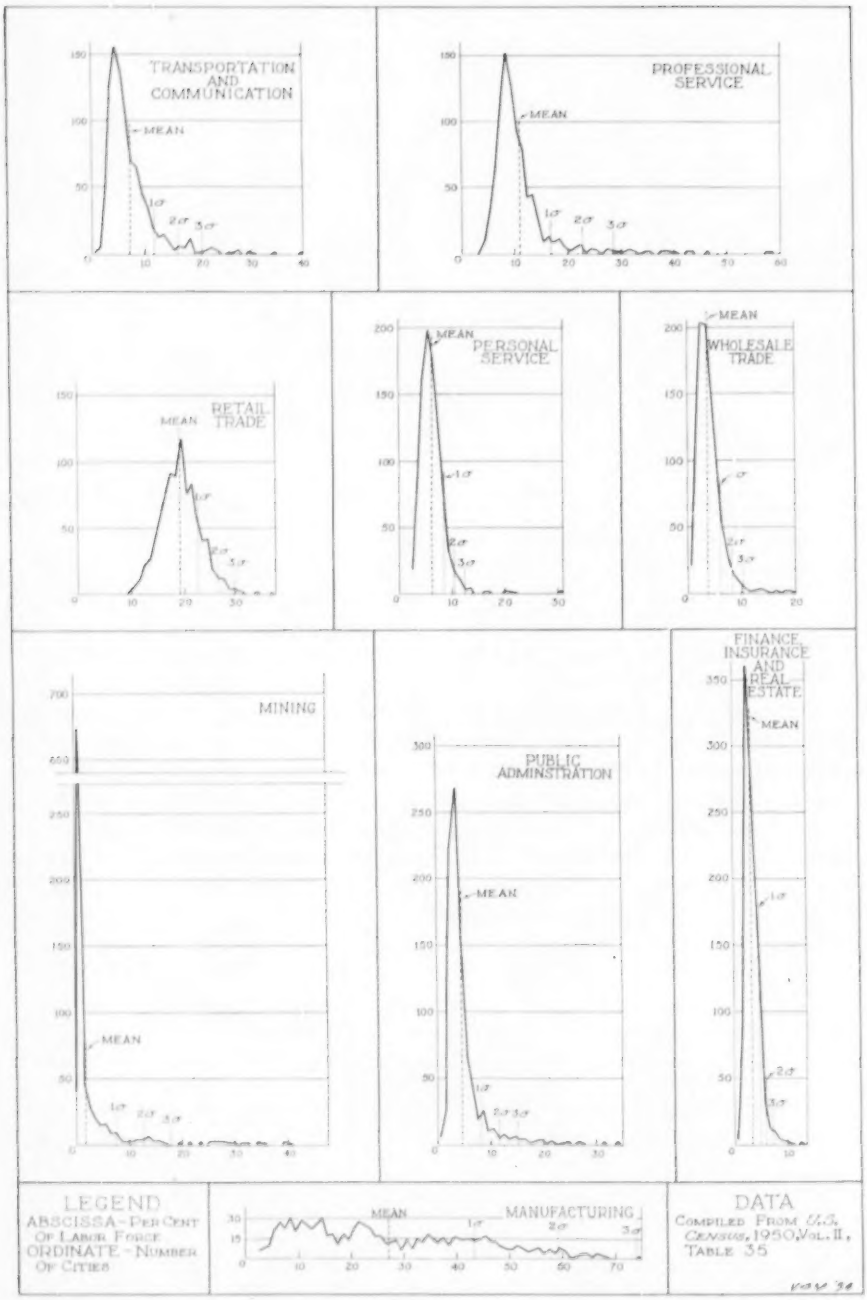

TRANSPORTATION AND COMMUNICATION
MEAN
1σ
2σ
3σ
PROFESSIONAL SERVICE
MEAN
RETAIL TRADE
MEAN
PERSONAL SERVICE
MEAN
WHOLESALE TRADE
MEAN
MINING
MEAN
PUBLIC ADMINISTRATION
MEAN
FINANCE INSURANCE AND REAL ESTATE
MEAN
LEGEND
ABSCISSA - PER CENT OF LABOR FORCE
ORDINATE - NUMBER OF CITIES
MEAN
MANUFACTURING
DATA
COMPILED FROM U.S. CENSUS, 1950, VOL. II, TABLE 35

FIG. 1.

greater proportions in the larger cities. However, in almost every case the trend is marked by several exceptions.

Frequency Variations

To portray graphically the distribution of economic services among American cities the frequency graphs shown in Figure 1 were constructed. These nine graphs show the frequency with which a given percentage of the labor force employed in an activity occurs in the 897 cities under consideration. In these graphs the vertical axis indicates the number of cities involved and the horizontal axis the percentage of the labor force in each service.

Striking variations in the distribution of the nine different services among our urban centers are apparent in Figure 1. A unique type of distribution is illustrated by manufacturing service. Retail trade exemplifies a second, quite different type. The seven remaining services might be considered together as a third type, somewhat similar to type two.

The manufacturing services provided by American cities display a greater variation, in terms of percentage of labor force employed, than any other activity. Unlike the distribution of any other activities, manufacturing shows no sign of "peaking" or grouping around some "typical" percentages. No city is without some manufacturing, but a few cities get by with less than 5 per cent of the labor force in this service. On the other hand, some cities have more than 65 per cent of their employed persons in this activity, and 91 cities have over 50 per cent of their labor force in manufacturing. Obviously, less that is meaningful can be said about an average or "normal" amount of manufacturing in a city than about any other activity. How much manufacturing should a city have to consider itself "balanced," for example?

Retail trade, perhaps because of its general necessity wherever concentrations of population are found, presents a distribution closer to a theoretical "normal curve" than any other service. In no city does less than 6 per cent of the working force serve the retail needs of the people. In some others 30 per cent and more, up to an extreme of 36.22 per cent, make their living providing this service. However, in about 120 cities the average is present, and there are almost the same number of cities with proportions below the average as there are with percentages above it.

The seven remaining activities fall into what may be considered a third general type of frequency distribution. Typically, most of the cities have a fairly common, rather low percentage of their labor force in a given activity. Then, in each case, there are a few cities in which the service is performed in outstanding amounts. Professional service, for example, commonly is supplied by from 6 to 12 per cent of the labor force. However, in a few cities these percentages rise many times above normal, with 30, 40, and, in several cases, nearly 60 per cent of the labor force employed in professional service. Generally speaking, transportation and communication, personal service, wholesale trade, finance, insurance, and real estate, and public administration follows a similar type of frequency distribution.

Mining perhaps warrants some special comments. This activity, which of course can exist only in the presence of minerals, is highly localized. This is the only activity which is not reported at all in a number of our cities. In 673 cities less than 1 per cent of the labor force is engaged in this activity. These, presumably, are workers in sand, gravel, and clay pits, limestone quarries, and

the like. On the other hand, where minerals are present the percentage may go up appreciably. For example, 14 cities have more than 25 per cent of their workers in this activity, and the maximum is 41 per cent (in Shenandoah, Pennsylvania).

THE CLASSIFICATION PROBLEM

We now shift our focus from the services performed in cities to the cities themselves. From the appearance of the above frequency distribution curves, particularly of the services in which some cities have a far greater proportion than those at the peak, it would seem that it would be valid to attempt to separate those cities at the extreme from the general average. This is the second major problem: How large a percentage of the labor force must be employed in a particular service to make the performance of the service far enough above normal to warrant separate classification?

This particular question is one that has received considerable attention from geographers as well as from others interested in cities. The thinking has usually been to the effect that, if an activity is concentrated in a city in a certain amount, this activity dominates the city's economic life and becomes its major function. As a result, several functional classifications of cities have been attempted. However, most students of urban geography would probably agree that the problem of classification has never been satisfactorily solved.

Perhaps the most significant and influential of all functional classifications of cities was that worked out by Chauncy Harris in 1943.[1] It is one of the first in which stated criteria are used, and is based on material from the 1930 Census of Population and the 1935 Census of Business. In this classification the criteria for each class of cities were chosen as follows: "On the basis of an analysis of cities of well recognized types an empirical solution (to the problem of ruling out local service employment) has been evolved by assigning higher percentages to some functions than to others. . . ."[2] For example, the classification of manufacturing (M′) has for its principal criterion "Employment in manufacturing equals at least 74% of the total employment in manufacturing, retailing, and wholesaling,"[3] plus a secondary criterion "Manufacturing and mechanical industries contain at least 45% of gainful workers."[4] In retail centers, "Employment in retailing is at least 50% of the total employment in manufacturing, wholesaling, and retailing and at least 2.2 times that in wholesaling alone."[5] Though the exact percentages are stated, we must have faith that the author has chosen cities of well recognized types—for they are not identified—and rely on his judgment as to the significance of the figures 74, 45, 50 and 2.2. Actually, the high reputation that this classification has maintained through the years attests to the general accuracy of the author's judgments.

A more up-to-date classification appears in a chapter by Victor Jones in the Municipal Year Book for 1953.[6] It is based on data from the 1948 Census of Manufacturing and the Census of Business of that same year. Jones' method is patterned after Harris', although his percentages are somewhat

[1] Chauncy D. Harris: "A Functional Classification of Cities in the United States," *Geogr. Rev.*, Vol. 33, 1943, pp. 86–99.

[2] *Ibid.*, p. 87.
[3] *Ibid.*, p. 88.
[4] *Ibid.*
[5] *Ibid.*
[6] Victor Jones: "Economic Classification of Cities and Metropolitan Areas," *The Municipal Year Book*, 1953, pp. 49–54 and 69, and Table IV.

different. However, the same comments about faith must apply.

Method Used in This Paper

It would seem to be a useful advance if a classification based on clearly stated statistical procedures could be devised in which each step could be checked and understood by other workers in the field. Once the data plotted on the distribution curves is prepared (Fig. 1), a number of statistical procedures are available to provide an objective, uniform method of measuring variation from the average. Perhaps the most useful device for our purposes is the Standard Deviation (hereafter referred to as the SD). In the first place (regardless of the theoretical criticisms that may be leveled against it) the SD is the simplest and most widely understood of all statistical measures of variation. Secondly, the *degree* of variation can be compared by use of the SD even if in some cases we are dealing with large percentages (as in manufacturing) or with small numbers (as in wholesale trade). This would seem to be an advantage over the simple percentage deviation used by Pownall.[7]

[7] L. L. Pownall, "Functions of New Zealand Towns," *Annals Assn. Amer. Geogrs.*, Vol. 43, 1953, pp. 332–350.

Standard deviations from the mean were therefore calculated for each of the nine activity groups and are presented in Table IV. The SD's are also indicated on the frequency curves in Figure 1 by the letter σ. Three degrees of variation from the average were recognized, and the cities grouped in their appropriate categories. Cities that are over +1 SD from the average in manufacturing were given a Manufacturing 1 (or Mf1) rating, over 2 SD's an Mf2 rating, over 3 *or more* SD's an Mf3 rating. A similar procedure was followed for each activity group.

TABLE IV

Averages and Standard Deviations for Selected Activity Groups

	Manufacturing	*Retail Trade*	*Professional Service*	*Transportation and Communication*	*Personal Service*	*Public Administration*	*Wholesale Trade*	*Finance, Insurance and Real Estate*	*Mining*
Average	27.07	19.23	11.09	7.12	6.20	4.58	3.85	3.19	1.62
S.D.	16.04	3.63	5.89	4.58	2.07	3.48	2.14	1.25	5.01
Average plus 1 S.D.	43.11	22.86	16.98	11.70	8.27	8.06	5.99	4.44	7.63
Average plus 2 S.D.	59.15	26.47	22.87	16.28	10.34	12.54	8.13	5.69	12.64
Average plus 3 S.D.	75.26	30.12	28.16	20.86	12.41	16.02	10.27	6.94	17.65

Inspection of Figure 1 indicated the point of the frequency curve at which the +1, 2, and 3 SD's occur. In a number of instances this point coincides fairly well with a "natural break" in the frequency curve. In other instances, as in the case of manufacturing, where a "natural break" would be difficult to determine, it provides a standard, objective division point. But, in any case, it is always clear where the divisions are made and why they are made at that point.

When applied to the 897 American cities chosen for this study, the method just described is not mutually exclusive, that is, a city may provide more than one type of service in outstanding pro-

portions. This would seem to be an asset to the classification rather than a weakness, fitting observed reality.

Many cities high in professional service, for example, are also high in personal service. Thus Boulder, Colorado, is classified Pf3Ps2, indicating that the city is three or more SD's above the average in professional service and over two SD's above the average in personal service. Occasionally, a city may be far enough above the average to receive a rating in three, and even, rarely, in four categories.

Some cities do not rank high enough in any service to come under any of the above nine categories. These are lumped together in a single Diversified group, although this is a somewhat misleading term. What is meant is that they are simply not unusually high in any service.

THE SERVICE CLASSIFICATION

All cities that were more than one SD above the average for any of the nine service categories were then classified, and plotted on maps included as Figures 2 to 10. Cities which were not outstanding in any category, as defined above, appear as Diversified cities in Figure 11. The following abbreviations were used to indicate the categories:

Manufacturing	Mf
Retail trade	R
Professional service	Pf
Transportation and communication	T
Personal service	Ps
Public administration	Pb
Wholesale trade	W
Finance, insurance and real estate	F
Mining	Mi
Diversified	D

A classification of 897 American cities appears as an appendix to this article.[8]

MANUFACTURING

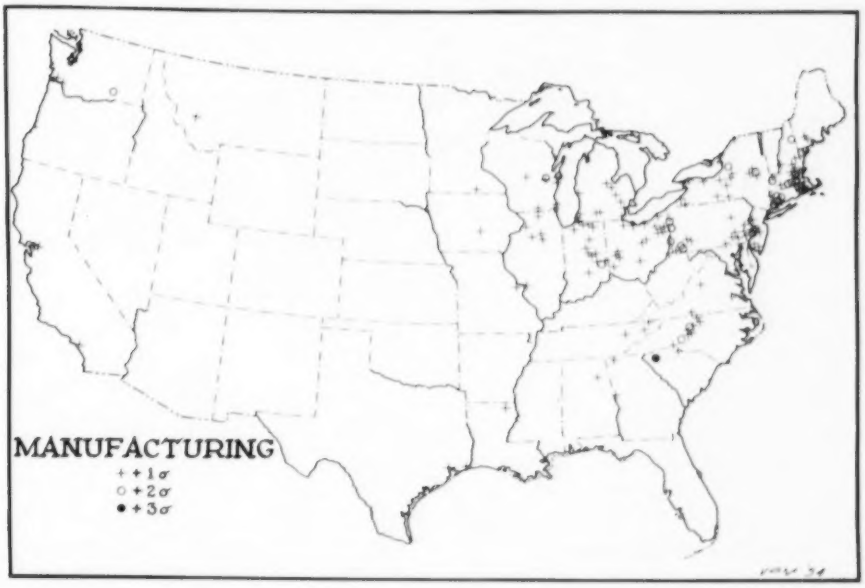
Cities that provide manufacturing service in outstanding amounts are more numerous than those of any other category, according to this classification. More than one-fifth—183 out of 897—of the cities are in this class. This is in spite of the fact that in order to be classified as a manufacturing center, over 43 per cent of a city's labor force must be employed in some type of manufacturing activity (average plus 16.04). In fact, over half of the labor force in some 93 cities finds employment in manufacturing a much higher concentration than is found in any other category.

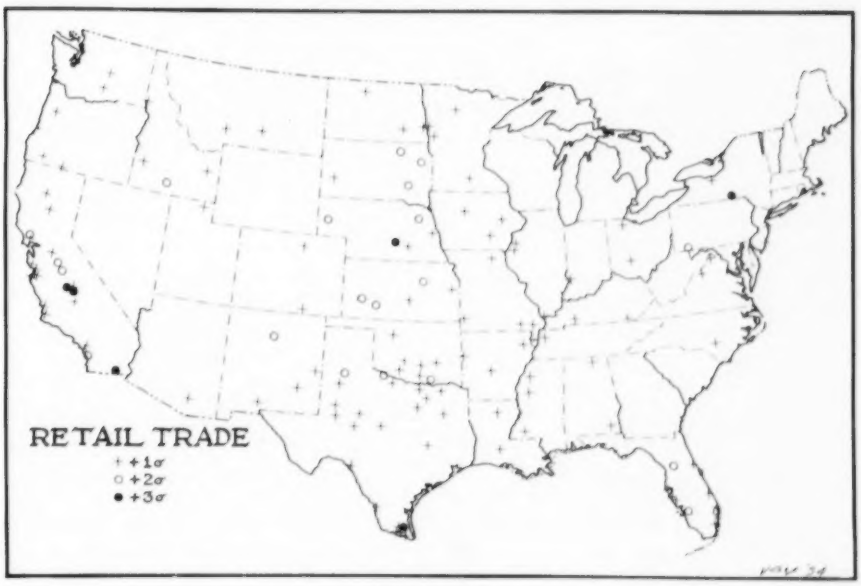
As Figure 2 indicates, cities in which manufacturing service is significantly above the average are strongly localized in the area north of the Ohio and east of the Mississippi, the general area recognized as a "Manufacturing Belt" by many geographers. Five-sixths of the Mf cities are in this area. Two-thirds of the remainder, some 19 cities, are located on either flank of the Appalachian Mountains. In no other category are cities so highly localized.

Manufacturing cities located outside of the above two areas deserve special mention. Some, such as Antioch, Pittsburg, and Costa Mesa, California, and St. Charles, Missouri, are small cities, located outside of large urbanized areas, but adjacent to them. Hoquiam and Longview, Washington, are lumber centers, while Richland, in the same state, is an atomic center. In the Middle West, Austin, Minnesota, is a meat packing center, and Newton, Iowa, is famous for washing machines. In addition there are Anaconda, Montana—copper; Bastrap, Louisiana—paper; Port Arthur and Baytown, Texas—petroleum.

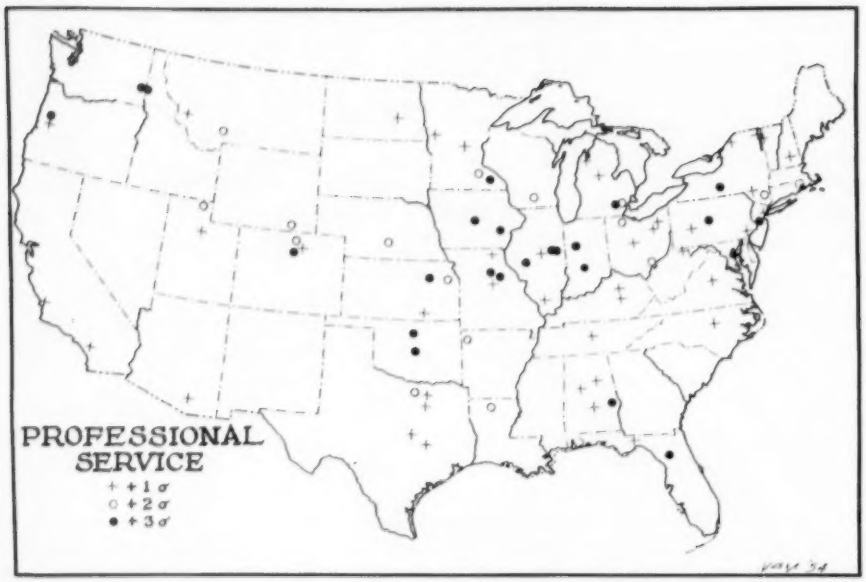
Only one city has a large enough proportion of its labor force in manufacturing to fall into the Mf3 category. It is the unincorporated area of Brandon-Judson, South Carolina (textiles), with 76.21 per cent of its labor force in manu-

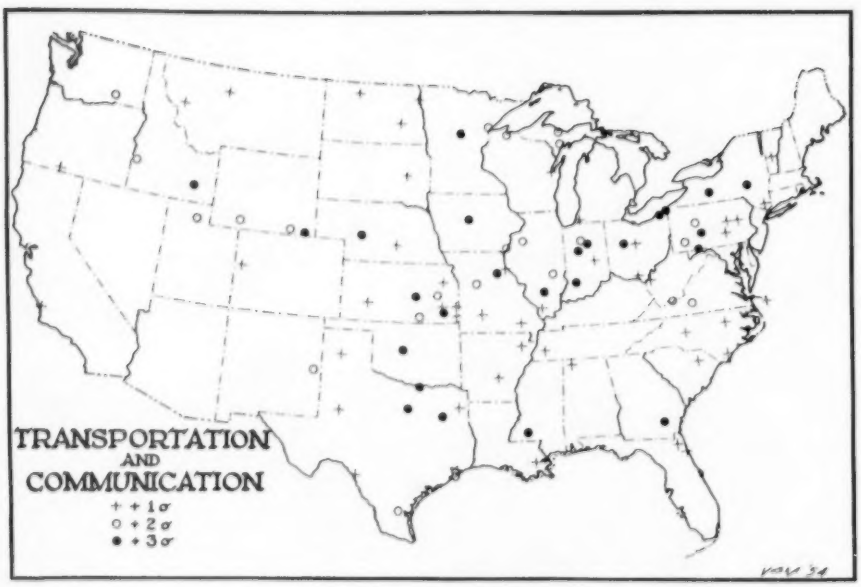
[8] A mimeographed table giving the SD values for all except the Diversified cities is available upon request from the author.





Figs. 2 and 3.


PROFESSIONAL
SERVICE
+ + 1 σ
○ + 2 σ
● + 3 σ


TRANSPORTATION
AND
COMMUNICATION
+ + 1 σ
○ + 2 σ
● + 3 σ

FIGS. 4 and 5.

facturing. There are 29 cities in the Mf2 group, only three of which are outside of the traditional "Manufacturing Belt." They are Kannapolis (textiles) and Thomasville (furniture), North Carolina, and Richland, Washington (atoms).

There are a few large cities in the manufacturing group. Detroit is the only urban area of over 1,000,000, and Providence, Rhode Island (583,000), is the next largest city in this group.

Retail Trade

The distribution of the 137 cities which provide retail services in outstanding proportion is considerably different from that of manufacturing cities, as is evident from Figure 3. Very few retail cities are found in areas in which manufacturing cities are concentrated. The largest concentration of the retail centers is a broad belt between the Rockies and the Mississippi River. California and Florida also contain important concentrations.

Six cities fall into the R3 category—where the number employed in retailing is more than three standard deviations from the average number in retailing. These cities are Kearney, Nebraska (36.22); Harlingen, Texas (34.25); Binghampton, New York (33.40); and three California cities—El Centro (30.95), Hanford (30.50), and Tulare (30.34).

Miami, Florida, is the largest city, 459,000 persons, to have a retail classification.

Professional Service

Eighty-one cities in the United States are outstanding in the proportions of their labor force engaged in the performance of professional services. The vast majority of these, 62 out of 81, are the sites of colleges or universities, or have a college or university nearby. This includes 34 out of 39 in the Pf2 and Pf3 groups. Apparently, in the United States when professional people dominate a community it is likely to be a college town.

The other professional cities tend to be medical centers of a wide variety of types. Two-thirds of the 19 non-academic centers in which professional people are present in abnormally large amounts are the sites of state hospitals for the insane. Another has a veterans hospital, one a hospital for the deaf and dumb, etc. Only Rochester, Minnesota, and perhaps Temple, Texas, are general medical centers. However, Rochester (32.30 per cent) is the only medical center to receive a Pf3 rating.

Professional centers have a widespread distribution with at least one center in almost every state. These centers by and large are small cities, with only one, Madison, Wisconsin, over 100,000 population.

Transportation and Communication

Many people have characterized the United States as "an experiment in transportation." And in some 96 cities transportation and communication are carried on in significantly above average amounts (see Fig. 5). Transportation in the United States is predominantly land transportation, and fully seven-eighths of these cities are railroad centers. Altoona, Pennsylvania; Hornell, New York; North Platte, Nebraska; and Cleburne, Texas, are outstanding examples. They are usually small cities, division and junction points along main line railways.

Exceptions to the above generalizations are made possible, in part, by the large shipments of iron ore on the Great Lakes. Of the seven lake ports in this category, six, Duluth, Minnesota, Ashland, Marquette, and Escanaba, Michigan, and Ashtabula and Conneaut, Ohio, are important ore ports. Green

Bay, Wisconsin, is more of a general lake port. Five cities along the Atlantic or Gulf coasts have an unusual proportion of the labor force in this activity. They are New Orleans, Galveston, St. Augustine, Jacksonville, and Newport News.

PERSONAL SERVICE

Personal service is performed by an outstandingly large proportion of people in 92 cities in the United States. Generally these are cities that for one reason or another attract a transient, or at least a semi-transient, population. Cities of sunshine in Florida, California, and Arizona account for more than one-fourth of all personal service centers. Famous old resort cities like Saratoga Springs, Atlantic City, and Hot Springs, Arkansas, are included. Also included are the newer Nevada cities of legalized gambling, nonwaiting matrimony, and easy divorce.

Other personal service centers include 14 of the smaller college towns, and a goodly number of cities that are near military posts. Rochester, Minnesota, previously mentioned as a medical center, has the largest proportion of personal service workers in its labor force—exactly one-third. Las Vegas, Nevada, is a close second with a percentage of 30.50.

PUBLIC ADMINISTRATION

Cities supplying public administration (or governmental) service are almost exclusively of two general types. They are either political capitals or are cities near large military installations. Of the 85 cities in this category, about one-fourth are political capitals. One of these is Washington, D. C., with a high of 31.60 per cent of its labor force employed in this activity. The other 23 cities are state capitals; those in the Pb3 group are Olympia, Sacramento, Harrisburg, Helena, Jefferson City, and Frankfort.

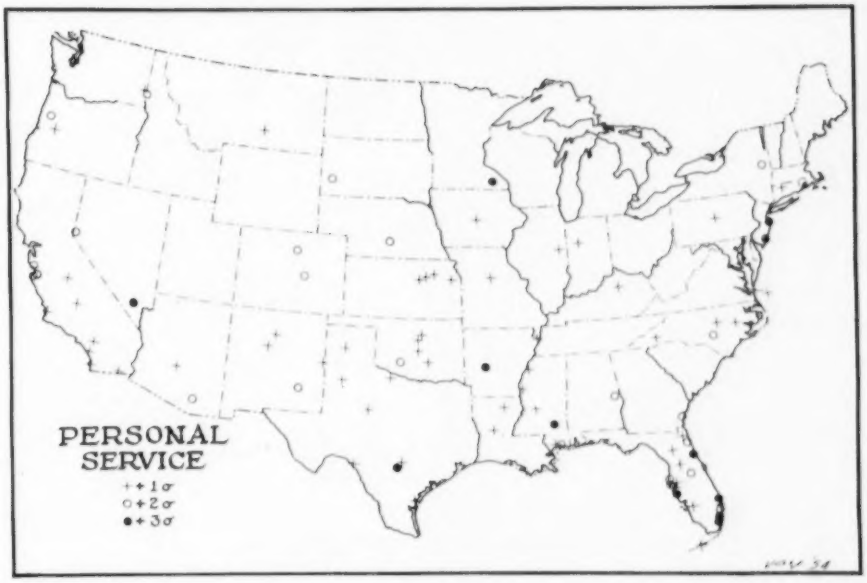
A somewhat new phenomena in American urban activities, but common in other parts of the world, is the service performed by what are usually called garrison cities. A large number of cities receive a classification in this group because of their proximity to large army, naval, or air installations. Warrington and Key West, Florida; Newport, Rhode Island; Riverview, Virginia; and Junction City, Kansas; are examples from this group.

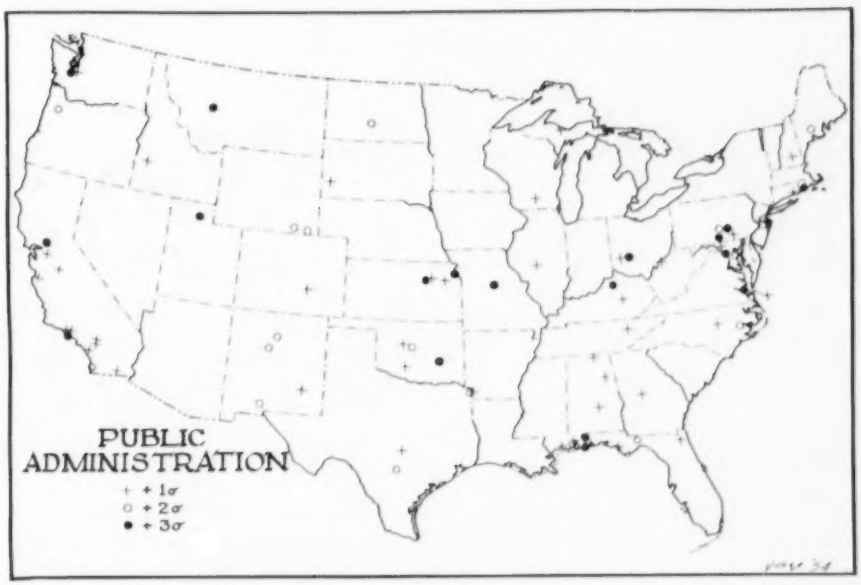
WHOLESALE TRADE

Wholesaling, as defined for census purposes, has really two meanings: first, the sale of commodities in large quantities to retailers; and, second, the assembly and sale of commodities to jobbers. Thus, small cities serving areas of intensive agriculture producing crops requiring sorting and packing, such as citrus fruits and vegetables, are often places where wholesale trade of the second type is permitted an unusual development (see Fig. 8). Most cities in the W3 category are of this type: Corona (citrus), El Centro (vegetables), Santa Paula (lemons), Watsonville (lettuce), and Brawley (vegetables), in California; Mercedes (citrus and vegetables), and Edinburg (citrus), in Texas; Sanford (celery), and Fort Pierce (vegetables), in Florida; Moorhead (potatoes), in Minnesota; and Suffolk (peanuts), in Virginia, are examples.

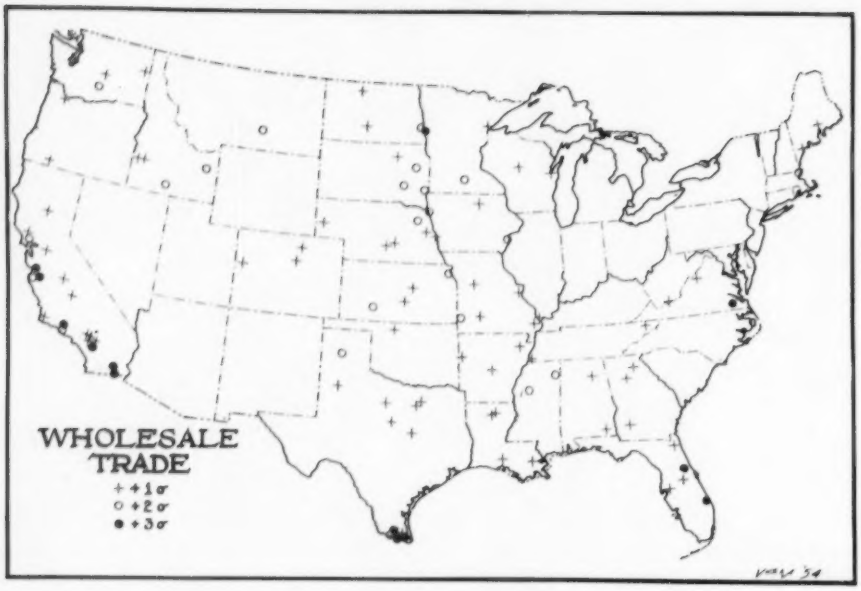
Wholesaling centers in the more traditional sense, as distributing points for bulk lot goods, such as groceries, hardware, or drugs, to the retailers in the surrounding towns, are usually somewhat larger cities. New Orleans, Denver, and Portland, Oregon, are good examples.

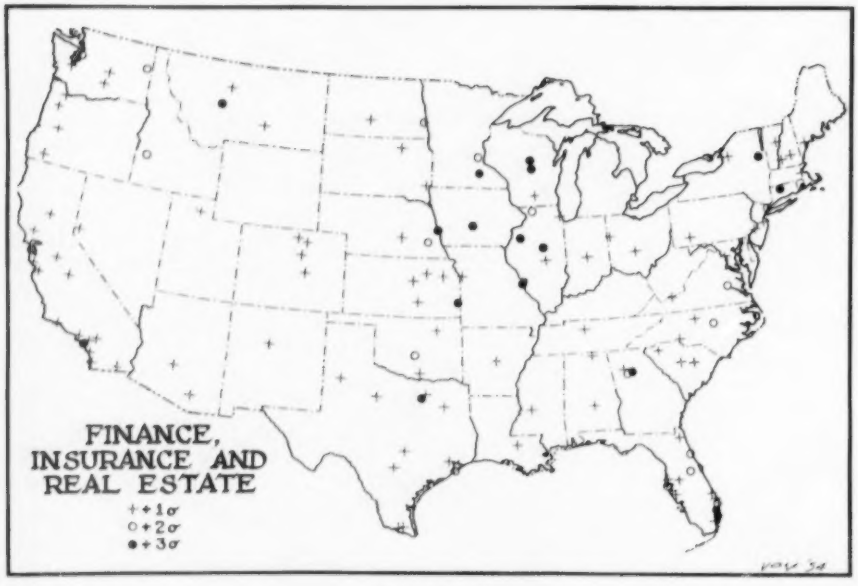
No cities in the area of the "Manufacturing Belt" are classified as wholesaling





Figs. 6 and 7.


WHOLESALE
TRADE
+ +1σ
○ +2σ
● +3σ


FINANCE,
INSURANCE AND
REAL ESTATE
+ +1σ
○ +2σ
● +3σ

FIGS. 8 and 9.

cities. Aside from this exception, their distribution is generally widespread.

Finance, Insurance, and Real Estate

In 123 cities, the services of finance, insurance, and real estate are performed in outstanding proportions. These cities are widely scattered over the country as indicated in Figure 9. Forty-two states in the union have at least one city of this type. This is a triple-headed category, and perhaps the cities in the group are also of three general types.

Three-fourths of the 17 cities in the F3 group are insurance centers. Hartford, Connecticut, Bloomington, Illinois, Stevens Point, Wisconsin, and Des Moines, Iowa, are outstanding examples.

On the other hand, one would expect that in the F3 cities of Newport Beach, California, and Fort Lauderdale and Hollywood, Florida, many persons support themselves by selling real estate.

This is the only category that includes a large number of the very large cities (seven of the twelve urban areas with over a million people fall into the F category) and perhaps these very large cities are not specialized, but are important in banking and other financial activities as well as insurance and real estate. New York, an urban unit of nearly 13 million persons, falls into the F2 category, and Dallas, with over half a million people, is an F3 city.

Mining

Fewer people in urban areas provide the nation with mining service than are required for any other activity. Only 46 of the 897 cities fit into this category. Although it is quite true that much mining activity takes place in settlements of less than 10,000 persons, it is also true that this activity generally provides employment for fewer people than any of the other services listed.

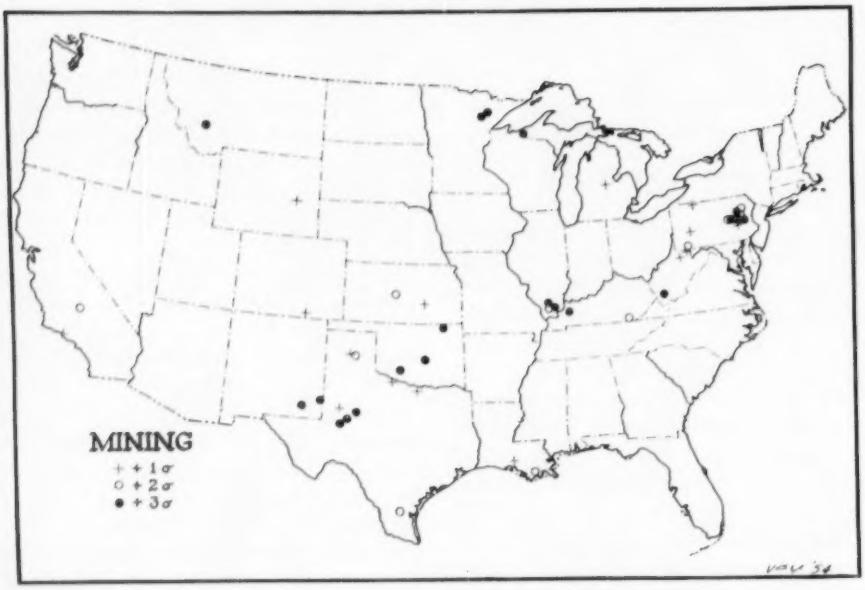
"Gold" someone said, "is where you find it." Likewise, above-normal mining activity is possible only in conjunction with mineral deposits and thus is easily explained. Of the 47 cities in this category, three, Hibbing (35.02 per cent) and Virginia City (23 per cent), Minnesota, and Ironwood (26.77 per cent), Michigan, are iron centers. One, Butte (32.10 per cent), Montana, is a copper city, and another, Carlsbad (29.46 per cent), New Mexico, is important for potash. All of the above, as the percentages would indicate are Mi3 cities. The remaining 42 centers important for mining are evenly divided between the older coal cities in Pennsylvania, West Virginia, Illinois, Kentucky, etc., and the newer petroleum cities of Texas, Oklahoma, Kansas, etc.

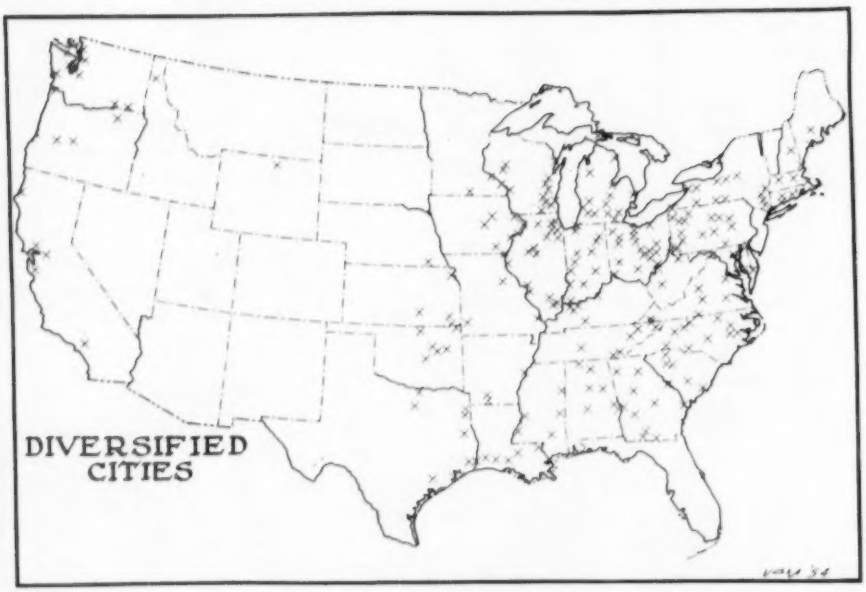
Diversified Cities

Two hundred forty-six cities are not sufficiently high in proportion of their labor force in any single service to receive a special classification and hence remain as more or less average or diversified cities. These cities generally exhibit a high degree of concentration in the northeast and southeastern part of the country, with the exception of Florida (see Fig. 11).

Summary

A study of this sort is perhaps more useful as a reference tool than as an end in itself. With the use of Tables I and II and Figure 1, for example, data from the 1950 Census of Population on the economic activities of any city can be quickly placed in its proper perspective in relation to all other United States cities. Then, too, by the preceding classification, cities that are similarly outstanding in any service can be separated, objectively and understand-





FIGS. 10 and 11.

ably, and subjected to further analysis.

And it is in the further analysis of cities with similar services that a classification of this sort is primarily valuable, though little use has been made in this respect of classifications available in the past. For example, how do cities in each of the above categories compare in other significant things, such as rate of growth, per capita income, ethnic composition of the population, behavior of employment during various phases of the business cycle, ratio of "basic" to "nonbasic" employment, and so on? Is there more correlation in these and similar items among cities of the same service type or among cities in the same region?

APPENDIX

A Service Classification of American Cities

Key

	Plus 1SD	*Plus 2SD*	*Plus 3SD*
Manufacturing	Mf	Mf2	Mf3
Retail trade	R	R2	R3
Professional service	Pf	Pf2	Pf3
Transportation and communication	T	T2	T3
Personal service	Ps	Ps2	Ps3
Public administration	Pb	Pb2	Pb3
Wholesale trade	W	W2	W3
Finance, insurance and real estate	F	F2	F3
Mining	Mi	Mi2	Mi3
Diversified	D		

ALABAMA

Anniston	Pb
Auburn	Pf3Ps2
Birmingham	D
Decatur	D
Dothan	RW
Florence	D
Gadsden	Mf
Huntsville	RPbF
Mobile	Pb
Montgomery	PbF
Opelika	D
Phenix City	D
Selma	D
Sheffield	T
Talladega	D
Tuscaloosa	Pf

ARIZONA

Amphitheater	R
Phoenix	PsWF
Tucson	Ps2PfF

ARKANSAS

Blytheville	R2Ps
Camden	D
El Dorado	D
Fayetteville	Pf2Ps
Fort Smith	RW
Helena	D
Hot Springs	Ps3R
Jonesboro	RTW
Little Rock–North Little Rock	TWF
Pine Bluff	TW
Texarkana	Pb

CALIFORNIA

Alisal	W3
Anaheim	W
Antioch	Mf
Bakersfield	Ps
Brawley	W3
Chico	RWF
Corona	W3Ps
Costa Mesa	Mf
El Centro	R3W3PsPbF
Eureka	D
Fresno	PsWF
Fullerton	W
Hanford	R3
Lodi	D
Los Angeles	F
Madera	R2
Merced	R2Pb
Modesto	RWF
Monterey	Ps2R
Napa	D
Newport Beach	F3R
Oceanside	R2PsW
Oildale	Mi2R
Ontario	D
Orange	Pf
Oxnard	Pb3W2
Petaluma	W2R
Pittsburg	Mf
Pomona	W
Redding	R
Riverside	PbWF
Sacramento	Pb3
Salinas	W2RF
San Bernardino	Pb
San Buenaventura	MiPb
San Diego	Pb2PsF
San Francisco–Oakland	F2
San Jose	D
San Luis Obispo	RPfT
Santa Ana	RPbF
Santa Barbara	Ps2F
Santa Cruz	Ps2RF
Santa Maria	RPsW
Santa Paula	W3Pb
Santa Rosa	R2WF
Seaside	Ps2RPb
Stockton	Pb
Tulare	R3W
Visalia	R
Watsonville	W3R

COLORADO

Boulder	Pf3Ps2
Colorado Springs	Ps2F
Denver	WF
Fort Collins	Pf2F
Grand Junction	TW
Greeley	RPfWF
Pueblo	Pb
Trinidad	RMi

CONNECTICUT

Ansonia	Mf2
Bridgeport	Mf
Danbury	Mf
Derby	Mf2
Hartford	F3
Meriden	Mf
Middleton	D
New Britain–Bristol	Mf2

New Haven	D
New London	Pb
Norwich	D
Shelton	Mf
Stamford-Norwalk	D
Torrington	Mf
Wallingford	Mf2
Waterbury	Mf
Willimantic	Mf

DISTRICT OF COLUMBIA

Washington	Pb3F

DELAWARE

Wilmington	D

FLORIDA

Bradenton	RPsF
Brownsville-B.-G.	Pb3
Clearwater	Ps2F
Daytona Beach	Ps3F2R
Fort Lauderdale	F3Ps2R
Fort Myers	R2Ps
Fort Pierce	W3RF
Gainesville	Pf3Ps
Hollywood	Ps3F3
Jacksonville	TPsPbFW
Key West	Pb3Ps
Lakeland	F
Lake Worth	R2F2Ps
Miami	Ps3RF
Ocala	R2Ps
Orlando	Ps2F2W
Panama City	Pb
Pensacola	Pb2
St. Augustine	Ps2T
St. Petersburg	Ps2F2R
Sanford	W3
Sarasota	Ps3RF
Tallahassee	Pb2Pf
Tampa	PsW
Warrington	Pb3
West Palm Beach	Ps3RF

GEORGIA

Augusta	D
Albany	W
Americus	D
Athens	Pf
Atlanta	F2
Brunswick	Ps2
Columbus	D
Dalton	Mf
Decatur	F3W
Dublin	D
Gainesville	W
Griffin	D
La Grange	Mf
Macon	Pb
Marietta	F
Moultrie	D
Rome	D
Savannah	D
Thomasville	D
Valdosta	D
Waycross	T3

IDAHO

Boise City	F2PbW
Caldwell	RW
Coeur d'Alene	D
Idaho Falls	W2R
Lewiston	R
Moscow	Pf3Ps2
Nampa	T2
Pocatello	T3
Twin Falls	R2W2

ILLINOIS

Alton	D
Aurora	D
Bloomington	F3
Cairo	RW
Canton	D
Carbondale	PfT
Centralia	T3
Champaign	Pb3Ps
Chicago	F
Collinsville	D
Danville	D
Decatur	D
De Kalb	D
Dixon	D
Elgin	D
Freeport	F2
Galesburg	T2
Harrisburg	Mi3
Jacksonville	Pf3
Joliet	D
Kankakee	D
Kewanee	Mf
La Salle	Mf
Lincoln	Pf
Macomb	R
Marion	Mi2
Mattoon	T2
Monmouth	F3R
Mount Vernon	D
Ottawa	D
Pekin	D
Peoria	D
Quincy	D
Rockford	Mf
Springfield	PbF
Sterling	Mf
Streator	Mf
Urbana	Pf3
Waukegan	Pb
West Frankfort	Mi3
Wood River	Mf

INDIANA

Anderson	Mf
Bedford	D
Bloomington	Pf3
Columbus	Mf
Connersville	Mf
Crawfordsville	D
Elkhart	Mf
Elwood	Mf
Evansville	D
Fort Wayne	D
Frankfort	T3
Goshen	Mf
Huntington	D
Indianapolis	F
Kokomo	Mf
Lafayette	D
La Porte	Mf
Logansport	T2
Marion	D
Michigan City	D
Muncie	Mf
New Castle	Mf
Peru	T3
Richmond	Mf
Shelbyville	D
South Bend	Mf
Terre Haute	D
Valparaiso	D
Vincennes	R
Wabash	Mf
Washington	T3
West Lafayette	Pf3Ps

IOWA

Ames	Pf3Ps
Boone	T3
Burlington	W2
Cedar Rapids	R
Charles City	D
Clinton	D
Davenport, Ia.–Rock Island–Moline, Ill.	D
Des Moines	F3
Dubuque	D
Fort Dodge	R
Fort Madison	T2
Iowa City	Pf3
Keokuk	D
Marshalltown	D
Mason City	D
Muscatine	D
Newton	Mf
Oskaloosa	R
Ottumwa	D
Sioux City	W2
Waterloo	D

KANSAS

Arkansas City	T2
Atchison	D
Chanute	T
Coffeyville	D
Dodge City	W2R2T
El Dorado	Mi
Emporia	T2
Fort Scott	F3T
Garden City	R2
Great Bend	Mi2
Hutchinson	WR
Independence	D
Junction City	Pb3R2Ps
Lawrence	Pf2Ps
Leavenworth	Pb3
Manhattan	Pf3PsPbF
Newton	T3
Ottawa	R
Parsons	T3
Pittsburg	T
Salina	RWF
Topeka	TPbF
Wichita	F
Winfield	Pf

KENTUCKY

Bowling Green	D
Frankfort	Pb3
Henderson	D
Hopkinsville	RPs

Lexington	PfPs
Louisville	D
Madisonville	Mi3
Middlesborough	Mi2R
Owensboro	D
Paducah	T2
Richmond	PfPb

LOUISIANA

Alexandria	Ps
Bastrop	Mf
Baton Rouge	D
Bogalusa	D
Crowley	D
Houma	Mi3
Lafayette	D
Lake Charles	D
Monroe	PsW
New Iberia	MiW
New Orleans	TWF
Opelousas	R
Ruston	Pf2
Shreveport	D
West Monroe	RW

MAINE

Auburn	Mf
Augusta	Pb2
Bangor	W
Bath	D
Biddeford	Mf2
Lewiston	Mf
Portland	WF
Saco	Mf
Sanford	Mf2
Waterville	D

MARYLAND

Annapolis	Pf3Pb2
Baltimore	D
Cambridge	D
Cumberland	T3
Frederick	Pb
Hagerstown	D
Salisbury	D

MASSACHUSETTS

Adams-Renfrew	Mf2
Boston	F
Brockton	Mf
Clinton	Mf
Fall River	Mf
Fitchburg	Mf
Gardner	Mf
Gloucester	W2
Greenfield	Ps
Haverhill	Mf
Leominster	Mf2
Lawrence	Mf
Lowell	Mf
Marlborough	Mf
Milford	Mf2
New Bedford	Mf
Newburyport	Mf
North Adams	Mf
Northampton	D
Plymouth	D
Southbridge	Mf2
Springfield-Holyoke	Mf
Taunton	Mf
Webster	Mf2
Worcester	D

MICHIGAN

Adrian	D
Albion	Mf
Alpena	D
Ann Arbor	Pf3
Battle Creek	D
Bay City	D
Benton Harbor	Mf
Cadillac	D
Detroit	Mf
Escanaba	T2
Flint	Mf
Grand Rapids	D
Holland	D
Ironwood	Mi3
Jackson	D
Kalamazoo	D
Lansing	D
Marquette	T2Pb
Menominee	Mf
Midland	Mf
Monroe	Mf
Mount Pleasant	PfMi
Muskegon	Mf
Niles	MfT
Owosso	D
Pontiac	Mf
Port Huron	D
Saginaw	Mf
St. Joseph	Mf
Sault Ste Marie	D
Springfield Place	Mf
Traverse City	Pf
Willow Run	Pf2
Ypsilanti	D

MINNESOTA

Albert Lea	D
Austin	Mf
Bemidji	R
Brainerd	T3
Duluth, Minn.–Superior, Wis.	T2W
Faribault	Pf2
Fergus Falls	RPf
Hibbing	Mi3
Mankato	W2R
Minneapolis–St. Paul	F2W
Moorhead	W3R
Owatonna	F3
Red Wing	D
Rochester	Pf3Ps2
St. Cloud	Pf
Virginia	Mi3
Winona	D

MISSISSIPPI

Biloxi	Ps2Pb
Clarksdale	RPs
Columbus	D
Greenville	D
Greenwood	W2R
Gulfport	Ps
Hattiesburg	D
Jackson	PsF
Laurel	Ps3
McComb	T3R
Meridian	D
Natchez	D
Pascagoula	D
Tupelo	W2
Vicksburg	D

MISSOURI

Cape Girardeau	D
Carthage	D
Columbia	Pf3Ps
Fulton	Pf3
Hannibal	T
Jefferson City	Pb3
Joplin	W2R
Kansas City	F
Kirksville	RPf
Mexico	D
Moberly	T3
Poplar Bluff	RT
St. Charles	Mf
St. Joseph	W
St. Louis	Ps
Sedalia	T2W
Sikeston	RW
Springfield	TW
Webster Groves	F3W

MONTANA

Anaconda	Mf
Billings	W2RPsF
Bozeman	Pf2RPs
Butte	Mi3
Great Falls	TF
Helena	Pb3F3
Missoula	PfT

NEBRASKA

Beatrice	D
Fremont	RW
Grand Island	TWF
Hastings	RW
Kearney	R3Pf2Ps2W
Lincoln	F2
Norfolk	R2W2
North Platte	T3
Omaha	F3W
Scottsbluff	R2W

NEVADA

Las Vegas	Ps3
Reno	Ps2F

NEW HAMPSHIRE

Berlin	Mf2
Claremont	Mf
Concord	PfPbF
Dover	Mf
Keene	F
Laconia	D
Manchester	Mf
Nashua	Mf
Portsmouth	D
Rochester	Mf

NEW JERSEY

Asbury Park	Ps3RPb
Atlantic City	Ps3R

Bridgeton	Mf
Burlington	Mf
Long Branch	Pb3
Millville	Mf
Phillipsburg	Mf
Princeton	Pf3
Red Bank	Pb2F
Trenton	Pb

NEW MEXICO

Albuquerque	Pb2PsF
Carlsbad	Mi3
Clovis	T2Ps
Hobbs	Mi3
Las Cruces	Pb2R
Roswell	Ps2RPb
Santa Fe	R2Pb2Ps

NEW YORK

Albany-Troy	Pb2
Amsterdam	Mf2
Auburn	Mf
Batavia	D
Beacon	Pf2
Binghamton	R3Mf
Buffalo	D
Corning	Mf
Cortland	Mf
Dunkirk	Mf
Elmira	D
Fulton	Mf2
Geneva	D
Glens Falls	F3
Gloversville	Mf
Hornell	T3
Hudson	D
Ithaca	Pf3
Jamestown	Mf
Johnstown	Mf
Kingston	D
Lockport	Mf
Massena	Mf
Middletown	Pf
Newark	RPf
Newburgh	D
New York–Northeastern N. J.	F2
Niagara Falls	Mf
Ogdensburg	Pf
Olean	D
Oneida	Mf
Oneonta	T3
Oswego	D
Peekskill	T
Plattsburgh	Pf
Poughkeepsie	D
Rochester	Mf
Rome	Mf
Saratoga Springs	Ps2
Schenectady	Mf
Syracuse	D
Utica	D
Watertown	F

NORTH CAROLINA

Albemarle	Mf
Asheville	Ps
Burlington	Mf
Charlotte	WF
Concord	Mf
Durham	D
Elizabeth City	D
Fayetteville	Ps2R
Gastonia	Mf
Goldsboro	D
Greensboro	F
Greenville	Ps
Henderson	D
Hickory	D
High Point	Mf
Kannapolis	Mf2
Kingston	D
Lexington	Mf
Monroe	D
New Bern	Pb2
Raleigh	F2PfPbPs
Reidsville	Mf
Rocky Mount	T
Salisbury	T
Sanford	D
Shelby	D
Statesville	D
Thomasville	Mf2
Wilmington	T
Wilson	D
Winston-Salem	D

NORTH DAKOTA

Bismarck	Pb2WF
Fargo	W2F2R
Grand Forks	T
Jamestown	RTPf
Minot	RTW

OHIO

Akron	Mf
Alliance	Mf
Ashland	Mf
Ashtabula	T3
Athens	Pf2
Bellefontaine	T3
Bowling Green	Pf2R
Bucyrus	D
Cambridge	D
Canton	Mf
Chillicothe	D
Cincinnati	D
Cleveland	D
Columbus	F
Conneaut	T3
Coshocton	D
Dayton	Pb
Defiance	D
Delaware	Pf
East Liverpool	Mf
Findlay	D
Fostoria	Mf
Fremont	D
Hamilton	Mf
Kent	Pf
Lancaster	Mf
Lima	D
Lorain	Mf
Mansfield	Mf
Marietta	D
Marion	T
Mount Vernon	D
Newark	D
New Philadelphia	D
Painesville	Mf
Piqua	Mf
Portsmouth	T
Salem	Mf
Sandusky	Mf
Sidney	Mf
Springfield	D
Steubenville	Mf
Tiffin	D
Toledo	D
Troy	Mf
Van Wert	DF
Washington	R
Wooster	Pf
Xenia	Pb3
Youngstown	Mf
Zanesville	D

OKLAHOMA

Ada	RPs
Ardmore	RF
Bartlesville	Mi3
Chickasha	R
Duncan	Mi3
Durant	R2
El Reno	T3Pb
Enid	RW
Guthrie	Ps
Lawton	Ps2RPb
McAlester	Pb3R
Miami	D
Muskogee	D
Norman	Pf3Ps
Oklahoma City	Pb2F2
Okmulgee	D
Ponca City	D
Sapulpa	D
Seminole	Mi3
Shawnee	D
Stillwater	Pf3Ps
Tulsa	F

OREGON

Albany	R
Astoria	D
Bend	D
Corvallis	Pf3Ps2
Eugene	PfPsF
Klamath Falls	RT
Medford	RWF
Pendleton	D
Portland	WF
Salem	PbF
Springfield	D

PENNSYLVANIA

Allentown-Bethlehem	Mf
Altoona	T3
Berwick	Mf
Bloomsburg	D
Bradford	Mi
Bristol	Mf2
Butler	D
Cannonsburg	D
Carlisle	Pb2
Chambersburg	Pb3
Coatesville	Mf
Columbia	MfPb

Connellsville	T2
Conshohocken	Mf2
Donora	Mf2
Du Bois	T2
Easton	Mf
Ellwood City	Mf2
Erie	D
Farrell	Mf2
Franklin	D
Greensburg	F
Hanover	Mf
Harrisburg	Pb3T
Hazleton	Mi2
Indiana	Mi2Pf
Jeannette	Mf
Johnstown	D
Lancaster	Mf
Latrobe	Mf
Lebanon	Mf
Lewistown	D
Lock Haven	D
Mahanoy City	Mi3
Meadville	D
Monessen	Mf2
Mount Carmel	Mi3
New Castle	T
Norristown	Mf
Oil City	D
Philadelphia	F
Phoenixville	Mf
Pittsburgh	D
Pottstown	Mf
Pottsville	Mi
Reading	Mf
Scranton	Mi2
Shamokin	Mi2
Sharon	Mf
Shenandoah	Mi3
State College	Pf3Ps
Sunbury	T
Tamaqua	TMi3
Uniontown	R2Mi2
Warren	D
Washington	D
Waynesboro	Mf
West Chester	Pf
Williamsport	D
Wilkes-Barre	Mi3
York	D

RHODE ISLAND

Bristol	Mf2
Central Falls	Mf2
Newport	Pb3
Providence	Mf
Woonsocket	Mf2

SOUTH CAROLINA

Anderson	D
Brandon-Judson	Mf3
Charleston	D
Columbia	F
Florence	T
Greenwood	D
Greenville	F
Orangeburg	D
Rock Hill	Mf
Spartanburg	D
Sumter	F

SOUTH DAKOTA

Aberdeen	R2WF
Huron	RTW
Mitchell	R2W2
Rapid City	Ps2RPb
Sioux Falls	W2F
Watertown	R2W2

TENNESSEE

Bristol	D
Chattanooga	D
Clarksville	D
Cleveland	D
Columbia	D
Dyersburg	R
Elizabethton	D
Jackson	T
Johnson City	W
Kingsport	Mf
Knoxville	D
Memphis	W
Morristown	D
Murfreesboro	Pf
Nashville	F
Oak Ridge	MfPb

TEXAS

Abilene	PsWF
Alice	Mi2
Amarillo	W2TPs
Austin	PbF
Baytown	Mf
Beaumont	D
Big Spring	RT
Borger	Mi
Brownsville	D
Brownwood	RW
Bryan	Pf
Cleburne	T3
Corpus Christi	PsPb
Corsicana	D
Dallas	F3W
Del Rio	RTPs
Denison	T3
Denton	Pf2
Edinburg	W3R
El Paso	T
Fort Worth	D
Gainesville	RMf
Galveston	T2F2
Garland	WF
Greenville	R
Harlingen	RWF
Houston	F
Kingsville	T2
Lamesa	MiR
Laredo	R
Longview	D
Lubbock	RWPsF
Lufkin	D
McAllen	RWF
McKinney	Pf
Marshall	T
Mercedes	W3R
Midland	Mi3
Mission	R
Nacogdoches	D
New Braunfels	Ps
Odessa	Mi3
Orange	D
Palestine	T3
Pampa	Mi2
Paris	R
Plainview	R2
Port Arthur	Mf
San Angelo	RPs
San Antonio	Ps3Pb2F
San Benito	W3
Sherman	D
Snyder	Mi3
Sweetwater	R
Temple	Pf
Terrell	Pf
Texarkana	Pb2
Texas City	D
Tyler	RF
Vernon	R2
Victoria	D
Waco	W
Waxahachie	R
Wichita Falls	RMiPs

UTAH

Logan	Pf2R
Ogden	Pb3T2
Provo	Pf
Salt Lake City	F

VERMONT

Barre	F
Burlington	Pf
Rutland	T

VIRGINIA

Bristol	D
Charlottesville	Pf
Danville	D
Fredericksburg	D
Harrisonburg	RW
Hopewell	Mf
Lynchburg	D
Martinsville	Mf
Newport News	TPb
Newsome Park	D
Norfolk-Portsmouth	Pb2
Petersburg	D
Richmond	F2
Riverview	Pb3Ps
Roanoke	T2
Staunton	D
Suffolk	W3
Waynesboro	Mf
Winchester	R

WASHINGTON

Aberdeen	D
Bellingham	D
Bremerton	D
Everett	D
Hoquiam	Mf
Kennewick	D
Longview	Mf
Olympia	Pb3
Pasco	T2
Port Angeles	D
Pullman	Pf3Ps
Puyallup	D

Richland	Mf2
Seattle	F2
Spokane	F2W
Tacoma	PbF
Walla Walla	D
Wenatchee	RWF
Yakima	W2RF

WEST VIRGINIA

Beckley	Mi3
Bluefield	T2WF
Charleston	D
Clarksburg	D
Fairmont	Mi2
Huntington, W. Va.–Ashland, Ky.	T
Martinsburg	D
Morgantown	PfMi
Moundsville	Mf
Parkersburg	D
South Parkersburg	Mf
Weirton	Mf2
Wheeling	D

WISCONSIN

Appleton	D
Ashland	T2
Beaver Dam	D
Beloit	Mf
Chippewa Falls	D
Eau Claire	D
Fond du Lac	D
Green Bay	TW
Janesville	D
Kenosha	Mf
La Crosse	D
Madison	Pf2PbF
Manitowoc	Mf
Marinette	D
Marshfield	W
Menasha	Mf2
Milwaukee	D
Neenah	Mf
Oshkosh	D
Racine	Mf
Sheboygan	Mf
Stevens Point	F3
Two Rivers	Mf2
Watertown	D
Waukesha	D
Wausau	F3
Wisconsin Rapids	Mf

WYOMING

Casper	Mi
Cheyenne	T3Pb2
Laramie	T2Pf2Pb2
Rock Springs	T2
Sheridan	D

IRON ORE PRODUCTION AT KIRKENES, NORWAY*

Trevor Lloyd

Dr. Lloyd is Professor of Geography at Dartmouth College.

KIRKENES is a Norwegian iron ore port on the southern side of Varanger Fjord close to the Norwegian-Soviet border. Its latitude, 69° 44′ N., is roughly equivalent to that of Disko Bay, Greenland, or Point Hope, Alaska, and its longitude, 30° 03′ E., places it due north of Alexandria, Egypt. Kirkenes lies about 220 miles north of the Arctic Circle and 130 miles farther north than the better known mining town of Kiruna in Sweden (Figs. 1 and 2). Distances to Kirkenes by sea are a significant factor since practically all its freight and passenger traffic moves by ship. Typical distances are:

Kirkenes to: Oslo, Norway . . . . . 1450 miles
Newcastle, England . . . . 1500 miles
Hamburg, Germany . . . . 1600 miles
Boston, Mass., U.S.A. . . 4150 miles

The sole justification for Kirkenes as a well-equipped seaport and settlement of about 3800 people is the occurrence a few miles inland of large iron ore deposits (Fig. 3).

The northerly location of Kirkenes may give a misleading impression of the severity of the local climate and the harshness of conditions under which mining, shipping, and living go on. In fact, the Kirkenes climate is surprisingly mild as is shown in Table I. The main characteristics of the climate may be summarized briefly as follows: Mean monthly temperatures range from about 11° F. in February to about 53° F. in August. Extreme temperatures range from an average low of −25° F. to a high of 78° F. On an average the daily mean rises above 32° F. on May 1 and sinks again below it on October 17. Precipitation is comparatively light, the annual total being about 16.2 inches with a summer maximum. Snow covers the ground on an average of 180 days in the year, the area usually being snow-free from early May through September. The mean depth of snow, in January through March, when it is greatest, is about 16 inches. The climate at Kirkenes is of course influenced by its location on Varanger Fjord. Stations even a few miles inland have more severe conditions, with the warmer summers and cooler winters typical of less maritime conditions.

Length of daylight, an important factor in mining and shipping operations, has a direct effect on the seasonal demand for electrical power and influences the daily lives of local residents. The long winter night in such latitude is, however, not as great a factor as is often supposed. Thus, although the sun does not rise at Kirkenes from the last day of November to January 14, the period when there is complete dark-

*Field work during July–August, 1949, and March–April, 1951, was made possible by a grant from the Arctic Institute of North America and the Carnegie Corporation. Preparation of the final report was aided by support from the U. S. Office of Naval Research. J. Peter Johnson made available notes of his visit to Kirkenes in 1952.

Maps were drafted by Don C. Foote, J. T. Tangerman, and Joan B. Snell with the author's guidance. The assistance of officials of A/S Sydvaranger at Oslo and Kirkenes is gratefully acknowledged.

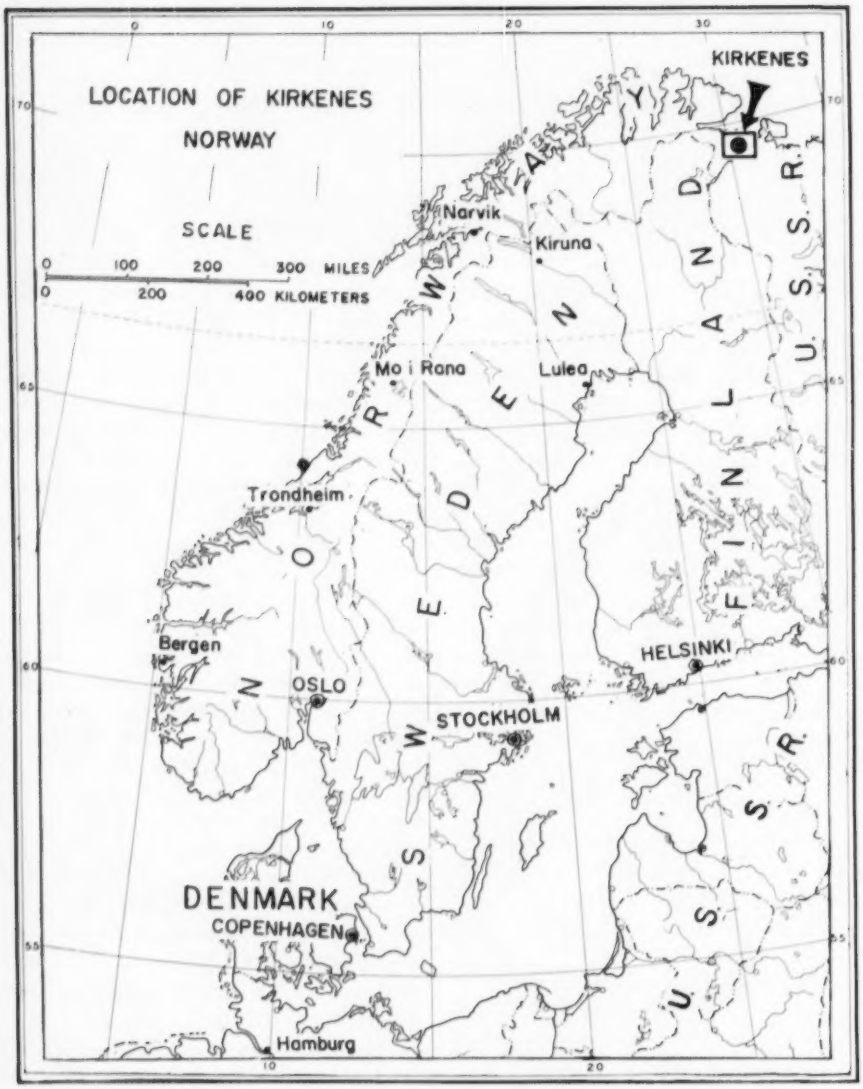


FIG. 1. Kirkenes lies in the northeast corner of Norway.

ness for the 24 hours is of course much shorter than this. Thus "twilight" never falls below four hours a day even in mid-winter and the sun does not set from mid-May to July 24. There are in all about 108 days with at least twilight throughout the night.[1]

[1] For details see *Den Norske Los* (Norwegian Pilot), Hefte X, Oslo. An interesting study of the effects of winter darkness on living conditions at Tromsø, Norway (Lat. 69° 39′ N.), is Nathaniel and Hortense Kleitman: "The Sleep-wakefulness Pattern in the Arctic," *Scientific Monthly*, Vol. LXXVII, No. 3, Sept., 1953. But see, also, the important note added by William G. Metcalf to emphasize the importance of twilight at this latitude.

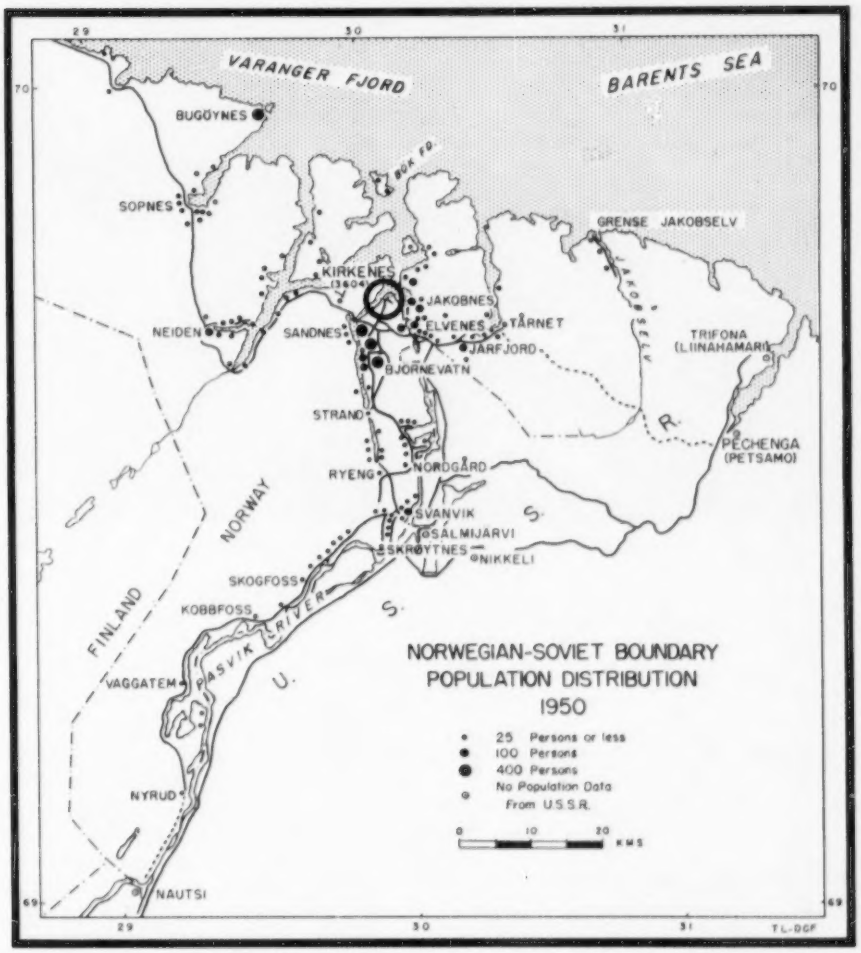


FIG. 2. Population distribution around Kirkenes. Solid lines represent main highways, and broken lines, unimproved roads.

Although navigation is open throughout the winter at Kirkenes, this is made possible by the use of a small icebreaker. While the open sea does not freeze,[2] the fresher water near the head of fjords and other inlets would do so if left undisturbed. The mining company at present uses a converted whale-catcher, about 130 feet long, as combined icebreaker and local pilot boat. This vessel is to be replaced by a properly designed icebreaker of about the same size. Vessels using the harbor need not be constructed to navigate ice. Fresh water lakes in the neighborhood freeze as does the Pasvik River. The fact that sea water temperatures are

[2] Mean annual temperature of the sea at this point is 4° C., monthly means vary from 2° C. in January to 8° C. in August. E. Frogner: "Means and Extremes of Sea Temperature by the Norwegian Coast," *Geofys Publik.*, Vol. XV, No. 3, Oslo, 1948.

FIG. 3. Kirkenes looking southeast, showing the settlement before wartime destruction. Iron ore plant is in right foreground. (Photo: courtesy of NTB, Oslo.)

TABLE 1

SUMMARY OF CLIMATE DATA FOR KIRKENES, NORWAY*

(Height above sea level, 5 m.)

	Precipitation		*Temperature* (*Mean temperature*[b] *1874–1933 in ° C.*)
	(*Mean precipitation 1901–1930 in mm.*)	(*Mean monthly depth of snow in mm.*)	
January	19	37	−10.1
February	20	44	−10.6
March	20	44	− 7.5
April	16	23	− 2.0
May	20	2	3.0
June	34	...	8.0
July	48	...	11.9
August	35	...	10.8
September	39	...	6.7
October	36	1	0.3
November	32	13	− 5.4
December	29	18	− 8.8
Year	348[a]	...	− 0.3
Snow cover	...	180 days	....
Mean maximum	...	...	25.7
Mean minimum	...	...	−31.6
Average date mean daily temperature first exceeds 0° C.			May 1
Average date mean daily temperature first falls below 0° C.			Oct. 17

*Temperatures from: *Geofysiske Publikasjoner*, Oslo, Birkeland, B. J., "Mittel und Extreme der Lufttemperature," 1936; Hesselberg, Th. und Birkeland, B. J., "Säkulare schwankungen des Klimas von Norwegen," 1940.

Precipitation from: Nedbøren i Norge, 1895–1943, Det Norske Meteorologiske Institutt, Oslo, 1949.

[a] Equivalent to 13.65 inches.

[b] There has been a small but appreciable change in these figures in the present century. The annual mean for 1901–1930 was 0.0° C., and that for 1916–1935 was still higher (1.1° C.) due largely to an increase in summer temperature.

relatively low in summer and close to freezing in winter is an asset since the water is used in steam condensers in the Kirkenes electrical power plant.

Kirkenes is remote from large centers of population and commerce. It is not connected to the European rail network, and in winter the gravel highway which links it to southern Norway (Route 50) is blocked by snow at several points. The sole all-year connection with the outer world is therefore by sea, and the town and the iron ore mine must depend on the sea for all their needs, apart from small amounts of food and lumber produced locally. Commercial airlines link Kirkenes with southern Norway from about April to October.[3]

LOCATION AND OCCURRENCE OF IRON ORE DEPOSITS

The iron ore exported from Kirkenes occurs on a peninsula between a long narrow arm of the sea (Langfjord) on the west and the valley of the Pasvik River on the east, and from 100 to 170 meters above sea level (Fig. 4). The area of the whole field is about 7 miles by 3 miles and includes several distinct sites. Present workings are in a limited area about 5 miles south of Kirkenes, near a lake, Bjørnevatn (Bear Lake) which gives its name to the near-by mining settlement.

The mining company holds title to an area about 13 miles by 3 miles, which includes the ore fields, Bjørnevatn (the mining settlement), and most of the Kirkenes townsite.

The mine is within sight of Soviet territory about two miles to the east.[4] When standing on a hill not far from the mine, it is possible to see fifteen miles to the south, the tall chimney of the Soviet nickel smelter at Nikkeli, and the lights of the two mining settlements can readily be seen from each other in winter. It was while searching for an extension of the Bjørnevatn iron ore fields across the international border in what was then Finland, that the nickel deposits were discovered in the early 1920's.

The Bjørnevatn ore occurs[5] as metamorphosed sediments of middle Precambrian (Karelian formation) age in an area which has been intensely folded. The ore itself is overlain and underlain by gneisses. The series is bounded in some directions by faults and elsewhere by granite. The ore now being worked is in a steeply dipping fold cut by faulting and intruded by dykes. It forms a rough V-shape, pointing northward. As the map shows (Fig. 5), the width of ore varies greatly. The area exposed by the present open pit covers ¾ mile by ½ mile. An intensive program of geological exploration is continuing in an effort to outline accurately the extent of the various deposits, as a preliminary to planning long-range mining operations.[6]

The Bjørnevatn ore now being mined is extremely hard magnetite inter-laminated with quartz with a relatively low iron content and resembles closely the

[3] A subsequent study by the author is to deal with transportation in Finnmark.

[4] The political geography of the international boundary is discussed in Trevor Lloyd: "The Norwegian-Soviet Boundary, a Study in Political Geography," Hanover, N. H., 1954.

[5] The most recent geological studies of the area are by Dr. Jens Bugge. His main conclusions are summarized in J. Kraft Johanssen: "Aktieselskapet Sydvaranger," *Tids. for Kjemi, Bergvesen og Metallurgi*, Nr. 26, March, 1950, pp. 1–10.

[6] An interim report on work in 1953 appears in an interview with J. Kraft Johanssen in *Sør-Varanger Avis*, Jan. 23, 1954.

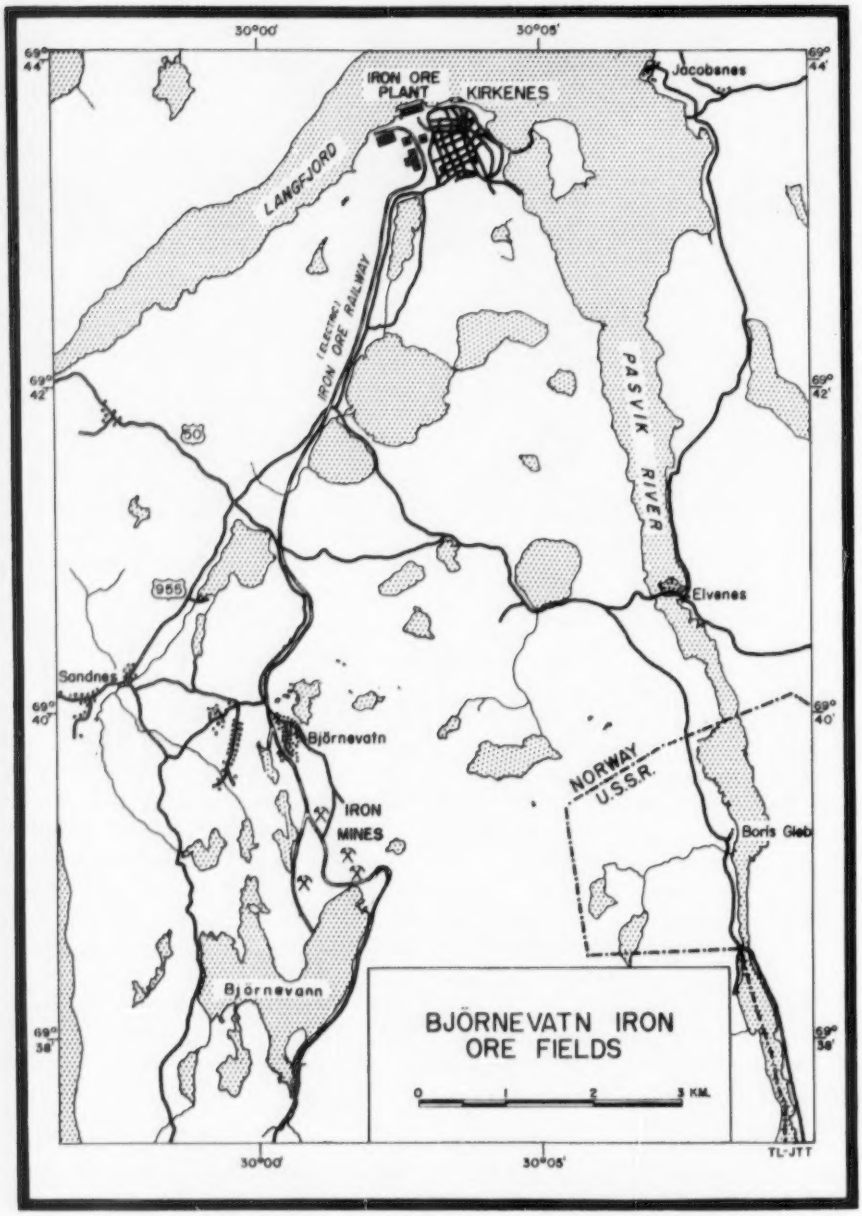


FIG. 4. Present iron ore workings are about five miles south of Kirkenes.

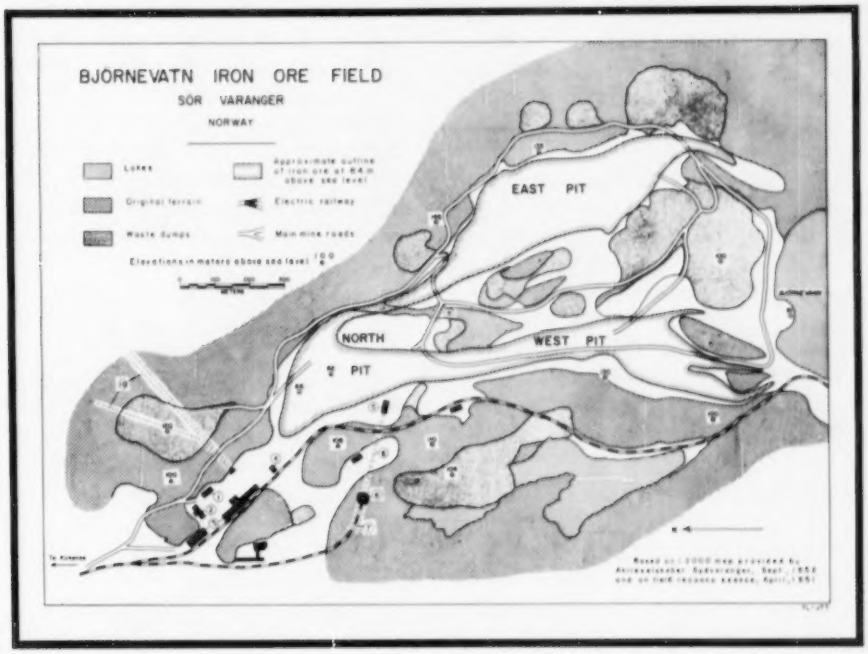


FIG. 5. The area exposed by the present open pit is about $\frac{3}{4}$ mile by $\frac{1}{2}$ mile. Numbers refer as follows: 1, office; 2, welfare building; 3, mechanical shops and stores; 4, drill bit dressing shop; 5, 54-inch gyratory crusher; 6, 10,000-ton ore bin; 7, railway tunnel under ore bin; 8, 48-inch conveyor belt (crusher to bin); 9, tunnel between North and East pits; 10, electric transmission lines from Kirkenes.

TABLE II

PRODUCTION AND EXPORT OF IRON ORE, KIRKENES, NORWAY

(Five year averages 1910–1939)*

	Number of Workmen	*Mined Ore (Tons)*	*Concentrate (Tons)*	*From Which Produced*		*Shipped (Crude)*
				Briquettes (Tons)	*Sinter (Tons)*	
1910–14	Insufficient Data	668,090	277,900	133,650	.....	234,014
1915–19	840	655,812	224,800	117,660	.....	176,800
1920–24	833	313,508	157,100	96,816	80,425[a]	232,080
1925–29	567	726,280	323,740	138,740	Insufficient Data	330,599
1930–34	672	914,800	398,500	196,800	.....	389,287
1935–39	1,180	1,651,220	704,520	369,060	.....	724,620
Total Tonnage 1910–39		24,649,552	10,422,800	5,262,730	434,850[b]	10,436,990

*Computed from annual statistics provided by A/S Sydvaranger, Oslo: letter of March 9, 1954.

[a] Four-year average as no information is available for 1920.

[b] Total based on years, 1921–26, only.

Minnesota taconites.[7] A typical specimen shows from 34 to 37 per cent of total iron. About 30–32 per cent is magnetite and about 44 per cent quartz. The sulphur and phosphorus content is extremely low. When compared with the Minnesota taconites, the ore is slightly richer in magnetite and somewhat more crystalline. However, the two are so similar that experience gained in operating the Norwegian field can be applied directly to the benefit of taconite mining in the United States.

From a production viewpoint, the chief problems to be faced in mining and processing the Bjørnevatn ore for export are as follows:

1. Drilling the ore and the surrounding rock preparatory to blasting it. The ore is extremely hard and the nine inch diameter holes can only be driven about five feet into the ore before the bit needs to be replaced.[8] In making a hole ready for blasting, only about 15 feet can be drilled in a typical 8-hour shift.
2. There is difficulty in breaking the large ore blocks blasted loose into sizes that can be handled by the primary crusher which needs to be exceptionally heavy to crush the ore.
3. In concentrating the ore to increase the content of iron and remove as much waste as possible, the problem is to extract the fine particles of magnetite from among the quartz. This requires a complex process of crushing, grinding, separating, washing, drying, and so on.

[7] For a comparative analysis of the three Minnesota taconites with that from Kirkenes, see Jens A. W. Bugge: "Sydvaranger Geology," *Mining World*, Vol. 15, No. 11, Oct., 1953, pp. 52–53. For recent reports of progress toward mining U. S. taconites see *Data sheets on Pilotac and Extaca*, Oliver Mining Division, U. S. Steel Corp., Mimeogr., 1953; "New industry grows from Taconite," *Monthly Review*, Federal Reserve Bank of Minneapolis, Feb., 1953; "Messabi's answer to the iron ore shortage," *Iron Age*, Vol. 171, March 12, 1953, pp. 127–34; "More iron from Minnesota's lean ores," *Eng. and Min. Jour.*, Vol. 154, Oct.,1953, pp. 88–90; "Report on Taconite," *Steelways*, Vol. 9, No. 5, Oct., 1953, pp. 1–5; "Taconite processing—E. W. Davis works at East Beaver Bay," *Construction Bulletin*, Dec. 3, 1953; "Erie ready to start work on big taconite project," *Eng. and Min. Jour.*, Vol. 155, Jan., 1954, pp. 78–79; C. R. Knowles: "Minnesota Taconite Developments," in *Facts about Minnesota Mining*, Iron Mining Industry of Minnesota, Duluth, Minn., Jan., 1954.

[8] Bits are sharpened as many as 80 times before being discarded. There is a specially equipped shop for this work at the mine.

HISTORICAL OUTLINE OF MINING NEAR KIRKENES

When one considers the many technical problems to be faced in producing a marketable product from the Kirkenes taconites, it is remarkable to recall that the operation began almost 50 years ago. Nowhere else in the world have such apparently unprepossessing ores been worked with such success over a long period of years.

The mining company "Aktieselskabet Sydvaranger" (named from the local term for the land south of Varanger Fjord) was founded in 1906 to work ores which had first been located in the late 60's of the previous century.[9] The initiative and most of the early capital came from Sweden, but the head office was in Oslo and the company has always been Norwegian. The building of harbor works, the concentrator, and other plant began at Kirkenes in 1907, but it was not until 1910 that the first fine black powder—or "slig" as it is termed in Norwegian—was produced. There were many technical difficulties in the early years, particularly with the equipment used to blast, crush and grind the hard ore, and the product, a fine powder mixed with

[9] A useful summary of the early history is Carl Lundh: "Selskapets Stiftelse og Første År," *Sør-Varanger Avis*, No. 28, April 9, 1952, p. 9.

a certain amount of water, proved a difficult cargo to ship.[10]

Additional finances were provided for the company by Hamburg bankers in 1908, and there has been a close contact with Germany ever since. Today, much of the concentrate is shipped to West German blast furnaces. The First World War brought financial troubles to the company due to the Allied blockade of German ports, and the postwar years were also difficult; but by the late 1930's Sydvaranger had again achieved a strong position, and, in 1939, at the end of the first era of Kirkenes mining, an impressive record had been achieved. A stock-taking at that time would have revealed something like the following (Table II and Fig. 6):

About 25 million tons of ore had been mined and shipped in the form of 10.4 million tons of concentrates (averaging 66–67 per cent iron, 7 per cent silica, .009 per cent phosphorus, .008 per cent sulphur). Of this total about half (5.3 million tons) had been exported in the form of briquettes containing about 65 per cent iron. The rest had been shipped as powder. The briquettes had gone mainly to Britain and the powdered concentrate to western European countries, mainly Germany. The annual rate of production had in 1939 exceeded 800,000 tons of concentrate, representing about 1,900,000 tons of ore mined. In all Kr. 215 million had been received for the product. This impressive record was set up, it needs to be recalled, in an extremely remote and undeveloped locality previously occupied by a few Lapp and Norwegian fishermen. By 1939, the company had about 1700 employees, and Kirkenes and Bjørnevatn were well-built and prosperous communities totalling about 7000 persons.[11]

The Second World War led not only to disruption of mining and ore shipments, but eventually brought about the nearly complete destruction of the mining and processing equipment. The town of Kirkenes and all other settlements in the area were almost obliterated by 1945. The occupying Nazi forces converted Kirkenes into a stronghold, heavily manned and armed, a base for naval operations and starting point for air attacks on north Russian convoys. As a consequence, it was very heavily bombed by the Allies, and in the early winter of 1944 what remained was almost completely destroyed by Nazi armies as they retreated westward.[12]

When the war ended, the mining company was confronted with an industry that had in effect been wiped out. To operate again, it would need complete reconstruction. Settlements at Kirkenes and Bjørnevatn, railroads, docks, and all the complex plant built up since the company's founding would have to be rebuilt. If, on the other hand, the undertaking was of doubtful economic worth under modern conditions, its destruction provided an opportunity to withdraw from the area for good. One valuable asset the company had: the experience and skill accumulated by its technical staff in the previous forty years. Sydvaranger had unique knowledge of how to mine and

[10] A vessel leaving Kirkenes with the first shipment in 1910 foundered somewhere near the North Cape, apparently due to the cargo shifting, and causing it to turn turtle.

[11] Data from discussions and correspondence with officials. Johanssen, *op. cit.*, p. 1, provides a short historical summary.

[12] The Nazi in charge, General Lothar Rendulic, has published a full account of his activities in the area, under the title of "Gekämpft—Gesiegt—Geschlagen," published at Wiesbaden, Germany in 1953.

Norwegians who suffered from the Nazi occupation and final "scorched earth" policy have published a record of those years as: B. R. Hellesnes, Ed.: *Finnmark i Flammer*, 2 vols., Kragerø and Trondheim, 1949 and 1950.

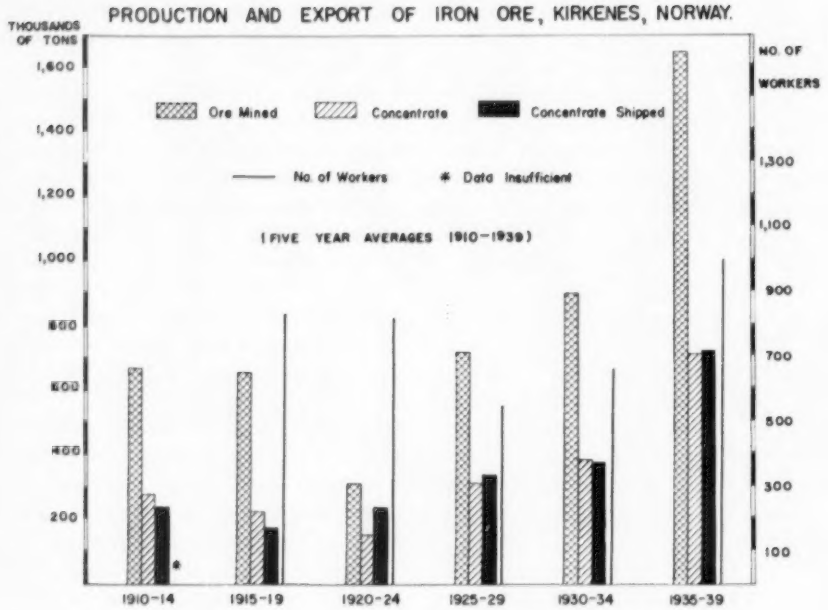


FIG. 6. Production and export rose through the 1930's.

process taconites and to do so in a remote and somewhat unfriendly physical environment. Any decision about the economic feasibility of the undertaking would hinge mainly on the long-term export market for the product, since Norway at the time had no iron smelting industry needing such large tonnages of ore.

POSTWAR RECONSTRUCTION AND EXPANSION

The future of Kirkenes mining obviously depended on securing a market for the product. Fortunately this was not difficult. Customers, both in Britain and on the continent, were ready to purchase the whole output of concentrate, immediately after the war. Thanks to direct ocean transport from concentrator almost to consumer, and the negligible rail transport from mine to shipping point, the Kirkenes product could reach European industrial markets at competitive and even premium prices. To meet the requirements of ore users, however, a proportion of the Sydvaranger product would need to be exported as briquettes or pellets.[12]

Any plans for the future would of course depend on the extent of good quality ore reserves, their accessibility, and the cost of extraction and processing. Assuming adequate reserves, the

[12] This is a somewhat technical but important consideration. Before the late war, Sydvaranger could sell an average of 750,000 tons a year by agglomerating some of the finely-ground concentrate to make it suitable for direct use in blast furnaces. The powdered concentrate has to be "sintered" by the importer before it can be used in the blast furnace. It so happens that West Germany has larger sintering capacity in relation to its ore consumption than has Britain, and so is able to process a larger part of the fine Sydvaranger concentrate locally. Hence, markets for Sydvaranger concentrate are governed by the importer's sintering capacity, unless the product can be formed into briquettes or pellets at Kirkenes. This problem also faces taconite producers in the United States and explains the efforts being made to devise a suitable pelletizing process.

technical problems of mining and processing would still remain to be solved.

The original mining and concentrating equipment installed in 1910 had been ultra-modern, and had been gradually modified as new techniques were devised. But this existing plant, or rather what was left of it in 1945, would need replacement. Finally there was the question of finance. To erect a plant capable of reaching even the prewar output would require an estimated Kr. 125 million (about $25,000,000), a very large sum in Norway at a time when other devastated areas farther south also needed reconstruction.

This last problem was eventually solved by a happy compromise between private and public financing under which the government subscribed about 60 per cent of the necessary capital,[14] while leaving the actual operation of the undertaking to a semi-independent board of directors. The dollar currency needed to secure special equipment from the United States was made available through Marshall Aid of $5,000,000.[15] Some other factors needing consideration were more problematical. Labor had always been something of a difficulty; in fact the output from the plant in prewar years had been roughly in proportion to the labor supply available. The industry employed about 1300 men in 1939 but the labor force had largely dispersed when operations ceased during the war, and less than 200 remained in 1944. There were few reasons why a new group of skilled workers should accept jobs "at the far end of the country,"[16] at the end of an expensive transportation route and where living conditions might be less attractive than in the south. Any plans for reopening the plant should, if possible, use a reduced labor force, provide attractive living conditions, and do everything possible to re-establish a sound community of well-qualified and contented people.

Systematic exploration of the ore fields, begun in 1946, confirmed the existence of ample reserves, and still more ore has been discovered since. Following work done in the 1953 summer, it was stated[17] that about 4000 additional meters of test drilling at the Bjørnevatn mine had outlined more than 50,000,000 tons of ore and the work was continuing. Apart from this ore occurrence, there are others in the vicinity which can be opened up when needed.

When work at the mine recommenced in 1950, a new operation plan was used, based on continuing use of open-pit methods, instead of changing to underground mining as had originally been intended. Under the new plan, open-pit working will continue for about 15 years. In the following ten years underground workings will gradually be introduced so that probably by 1975 mining will be completely underground.

The reasons behind this change in technique are interesting. The present bottom of the open pit is on an average about 82 meters above sea level, although at one point it is only 66 meters above sea level. At the southern end of the pit is a lake (Bjørnevatn), whose surface is about 81 meters above sea level (see Fig. 5). This is to be par-

[14] Before World War II, 43 per cent of the capital of A/S Sydvaranger had been German owned. This capital automatically became Norwegian government property at the war's end.

[15] Details of the company's financing are given in *Årsberetning* (Annual Report), A/S Sydvaranger, 1952, Oslo, 1953.

[16] The journey from Oslo to Kirkenes is equivalent in distance to that from Oslo to Albania, or from Boston, Mass., to Ungava Bay, Canada.

[17] *Tromsø*, Jan. 27, 1954. For details of the drilling program and a summary of results, see Jens A. W. Bugge, *op. cit.*, 1953, pp. 52–53.

tially drained through a 2.5 km. long tunnel driven in from Langfjord.[18] Draining the lake will expose additional ore for open-pit mining, will provide space for dumping waste rock, and will prevent seepage into underground workings. Sufficient water will remain in the lake to supply the local settlement. The open pit will eventually be carried down to 30 meters below sea level, at which time underground mining will become necessary, as mentioned above.

Economic considerations lie behind these plans. It is estimated that about 45 million tons of ore can be extracted with removal of about 20 million tons of waste rock. Open mining will cease when the ratio between the two becomes 1:1, i.e., when a ton of waste must be removed for every ton of ore. Open mining is preferred for many reasons. It requires only two-thirds of the labor force, permits greater and more flexible use of machinery, and planning and operation of the work is simpler. At first sight an apparent objection to it is the winter climate. This has not proved a serious handicap in the past. Temperatures are less extreme than those in the Minnesota iron-mining area, although the winter is longer. Snowfall is relatively light and has proved to be an advantage as snow and ice provide an excellent surface for the heavy haulage vehicles, reducing wear and tear on the tires. Working lights are needed for 24 hours a day in winter, but the long period of daylight in summer offers some compensation.

An additional factor in favor of open-pit mining has been the development, largely in the United States, of very heavy ore-moving equipment such as shovels and trucks. Electric shovels now in use can load 4½ cubic yards of ore at a time, into 35 ton carriers.[19] These and other vehicles are able to operate over mine roads of about 8 per cent grade, which is much steeper than was possible with the locomotives employed in the old mine. Hence the open pit can be carried to a far greater depth.

Certain considerations of a political-economic sort also favored reopening of the Sydvaranger mine after the war. Finnmark, the northernmost county in Norway, has long been a "distress area." Seasonal unemployment in fishing and farming has been chronic. Economic backwardness at a distance from the center of government in Oslo has tended to encourage radical political beliefs based on supposed neglect. The rise in power of the Soviet Union, whose territory is adjacent to Finnmark, made this problem even more acute. Furthermore, the area is clearly not unimportant in North Atlantic defense strategy. In the immediate postwar years the Norwegian government for these and other reasons was determined to expand the economy of North Norway. The aim was to provide a broader economic base by encouraging mining and other industries in order to provide a market for local products and to maintain more regular employment. While some of the projects which formed a part of a coordinated North Norway Plan[20] could mature only over a long period of years, Sydvaranger mining

[18] Press interview with J. Kraft Johanssen in *Sør-Varanger Avis*, June 23, 1954.

[19] In 1953 the mine used 20 trucks of 22–35 ton capacity. Some mines elsewhere now use shovels with buckets of 6 cu. yard capacity and some engineers favor 7½ yard buckets on big jobs.

[20] For a complete description of the plan see *St. meld. nr. 85* 1951. Utbyggingsprogrammet for Nord-Norge (Development Program for North Norway).

The economic outlook for iron-ore exporters in Europe was uncertain in 1946. Private capital would have hesitated to embark on a large-scale enterprise such as reconstructing A/S Sydvaranger's plant required. In the light of this, government action became very important.

could probably revive the derelict local economy relatively quickly. This explains in part the readiness of the government to provide capital for the company and a high priority in securing new equipment.

When the decision to proceed with reconstruction was made in 1946, plans were laid out for completely new mine and processing plants. These new plans called for the use of more mechanical power, a reduction in man-power, and some increase in output.

PROCESSING THE ORE

The processes needed to mine Bjørnevatn ore and convert it into a finished product ready for shipment are, in outline, these:

The ore must be blasted out from the open pit, and larger blocks broken by further blasting. The ore has then to be broken down in a crusher to a size suitable for transfer by railroad to Kirkenes. There it needs further crushing and grinding to a fine powder, the magnetite must be separated from waste rock, and the product must be dried and formed into briquettes or pellets and loaded into the vessel for shipment. At various stages, conveyors are needed to transfer material from one point to another, as well as storage bins of various sizes, classifiers to sort the products, and so on. The waste rock must also be disposed of.

The Original Plant

The original plant was elaborate and ingenious, but as a pioneer undertaking it proved after 30 years to be less efficient than it could be. There were for example 32 separate sets of units operating side by side at the concentrator—in effect 32 separate plants, all of small capacity.[21] They needed close supervision by a large staff of workmen, and maintenance was expensive. The so-called "briquettes" which formed about half of the end-product, were in fact massive conical blocks of concentrate, each weighing 44 pounds (20 kilos). These too needed individual attention. The final product was excellent, as less than 3 per cent of the magnetite found in the original ore was lost. The concentrate when ready for shipment consisted of 91.5 per cent magnetite, 6 per cent quartz, and 2.5 per cent other materials. To this was added 5–7 per cent water when it was shipped as powder.

In addition to supplies of ore, the plant needed electricity for its many operations, water in large amounts, steel balls and rock pebbles for the mills, as well as countless other supplies. In converting each 2.3 tons of ore into a ton of concentrate, about 45 kWh of electricity were used. The source of most of this was a steam plant at Kirkenes using coal imported from Britain, Poland, and Germany. Furthermore, each ton of ore needed 4½ tons of sea water while being processed. In addition, fresh water was needed for steam making, etc. For securing water, the plant was well located between the sea on the north and a string of three small lakes on the south.

The New Plant

In outline, the modern processing of the ore is as follows:

Holes, nine inches in diameter, are drilled vertically into the ore, and a carefully calculated charge of powder is placed in them. The ore is then blasted out in "benches" about 44 feet high. The ore blocks are loaded by electrically-powered, tracked shovels into the large trucks already mentioned,

[21] See Fig. 2, "Flowsheet for the old crushing and concentrating plants," in J. Kraft Johanssen: "Iron Ore Concentration at Sydvaranger, Norway," *Journal of the Iron and Steel Institute*, Vol. 162, 1949, p. 4.

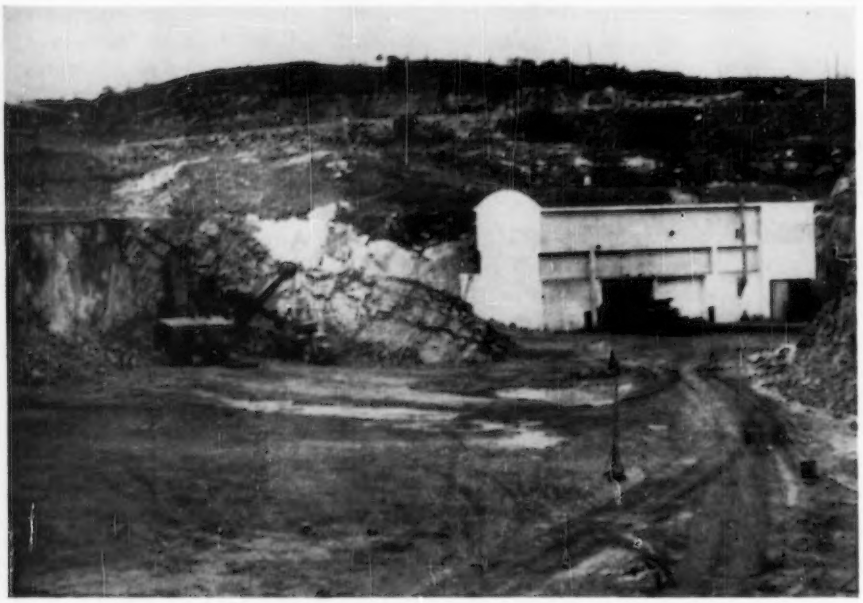


FIG. 7. Primary crusher building in North pit, Bjørnevatn. (Photo: courtesy, *Mining World.*)

and carried to the crusher (Fig. 7). Bulldozers clean up the smaller pieces of ore, and a grader works full time maintaining good road surfaces. As it is cheaper to crush large blocks of ore than to drill and blast them into pieces, one of the world's heaviest ore crushers, designed to A/S Sydvaranger's specifications but built by Nordberg in Milwaukee, Wisconsin, has been installed at the Bjørnevatn mine. Weighing about 500 tons, it is able to take blocks of ore up to 54 inches in size,[22] and can handle up to 2000 tons of ore each hour. To withstand the enormous stresses involved in crushing the very hard ore to a size no larger than 6 inches, the main shaft of the rotary crusher was made 50 inches in diameter and weighs 100 tons. A constant problem with such an enormous crusher is to dispose of the heat generated. About 100 gallons of oil per minute circulate in this machine, serving both as lubricant and cooling agent. Incidentally, the cold winter climate is in this case an advantage, since the oil cools naturally. When the crusher is idle in winter some heating is needed.

From the crusher the ore drops into a bin from which it is discharged onto a conveyor belt. This underground conveyor, 42 inches wide, runs for about 850 feet at an angle of 15½ degrees rising about 225 feet to the top of a 10,000 ton ore bin excavated in the solid rock.[23]

Standard gauge railroad tracks run under this main storage bin. Trains of about fifteen 40-ton cars, hauled by a 1200 H.P. diesel-electric locomotive carry the ore the 5½ miles to Kirkenes in about 15 minutes. In this way about 200,000 tons a month are transported year-round. As is to be ex-

[22] The building which houses the crusher has been made large enough to take a second machine should this prove necessary.

[23] This and other aspects of the mine at Bjørnevatn are shown in Fig. 5.

pected, there is some trouble from ore freezing into the cars in winter.

Subsequent treatment of the ore at Kirkenes is not complex in principle, although it is difficult to carry out in practice (Fig. 8). The ore must be crushed to smaller size, and then transferred to a ball mill where it is ground with about 80 tons of five-inch steel balls. These balls are of course gradually worn away, but in the process the ore is ground to particles of about 1/20 mm. in size. It is at this stage that large amounts of sea water are added requiring a flow of up to 30 cu. meters a minute. The finer particles of ore are separated from the larger by screening, and the heavy pulp of ore and water is passed over a series of rubber-coated magnetic drums[24] which attract the magnetite but allow the waste rock to escape. This waste is carried, still mixed with water, through a tunnel to be dumped in Langfjord. Powerful vacuum filters then extract most of the water from the concentrated magnetite, which is finally dried in heated kilns until it contains 5–7 per cent water.

In the prewar plant part of the final product was made into large briquettes by the "filter-briquetting" method developed by the company. At present (1955) the whole product of the new mill is sold as powder. However, work has started on a series of furnaces to be used in making pellets—small balls of concentrate about 10–30 mm. in diameter, which are indurated by heating. Tests have shown that these are excellent for blast furnace use, since they withstand crushing. A pellet producing plant is being designed for an initial production of 100,000–150,000 tons a year[25] with capacity expanding to an estimated 500,000 tons a year.

The concentrate ready for export is carried by conveyors (Fig. 9) to a storage bin holding 70,000 tons, excavated in the cliff near the export quay.[26] Additional storage space is to be excavated so as to double that now available. The ore is carried to the ship's hold on conveyor belts, as required (Fig. 10), at a rate exceeding 1000 tons an hour.[27] Vessels drawing 30 feet, and up to 15,000 tons, can be accommodated at the wharves, but typical ore carriers are of about 10,000 tons.[28]

PROVISION OF ELECTRIC POWER

Electric power sufficient to handle the heavy demands of the mine, railroad, and concentrator, as well as the lighting and power needs of various communities, has not been easy to provide.[29] Although Norway has a justified reputation for being a leader in hydro-electric development, the Kirkenes area is not particularly well endowed. The best near-by hydro-power sites are waterfalls on the Pasvik River a few miles east of Kirkenes, but as the river forms the boundary between Norway and the USSR there seems no

[24] The new plant has greatly simplified the concentrating process by reducing the number of machines employed. For a recent discussion of this and other types of equipment used in processing taconite ores see Fred D. DeVaney: "Iron ore beneficiation; New taconite projects now assured," *Eng. and Min. Jour.*, Vol. 155, No. 2, Feb., 1954, pp. 123–125.

[25] *Sør-Varanger Avis*, Jan. 23, June 26, and Dec. 8, 1954.

[26] When export of ore to Germany was temporarily delayed during the 1953–54 winter an additional 200,000 tons was stored in the open air at Kirkenes.

[27] Five men control equipment which handles up to 1140 tons an hour, so that ships arriving in the morning are loaded ready to sail in the afternoon.

[28] A/S Sydvaranger operates only one ore carrier, a vessel of 7800 tons, registered at Kirkenes. German importers provide their own tonnage, but Britain and Belgium do not.

[29] Power shortages have been common in eastern Finnmark in recent years and rationing of the available supply has been necessary. See, for example, *Finnmark Tidende*, July 11, 1953.

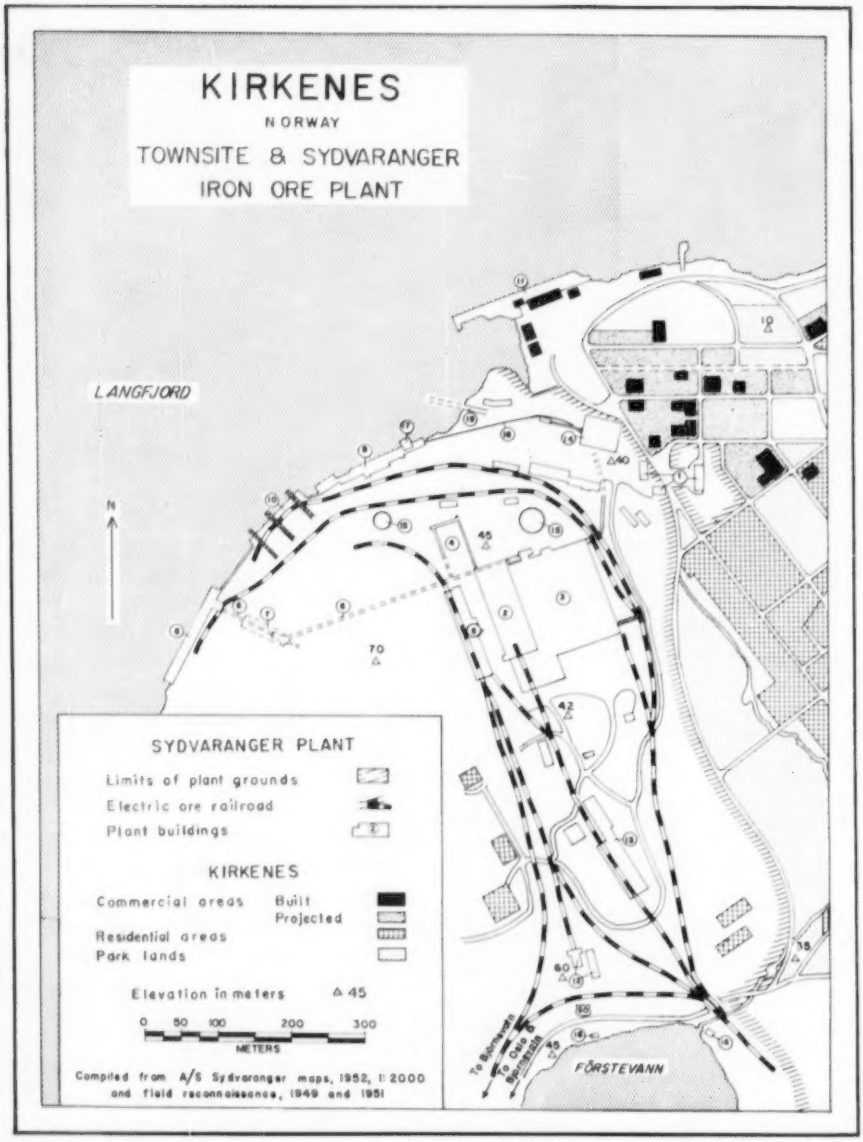


FIG. 8. The ore is treated in the Sydvaranger Plant. Numbers refer as follows: 1, administration; 2, separation plant; 3, concentrate storage; 4, conveyors; 5, fine crushing plant; 6, underground conveyor belt; 7, concentrate bin (underground); 8, concentrate loading dock; 9, coal dock; 10, wharf with cranes; 11, steamer wharf (public); 12, railroad sheds; 13, machine shop; 14, steam power plant; 15, oil tank; 16, fresh water pump station; 17, sea water pump station; 18, sea water conduit; 19, slipway.

FIG. 9 (left). Kirkenes ore plant and enclosed conveyors seen from public quay. Storage bin was excavated within hill at right.

FIG. 10 (right). Kirkenes ore wharf on Langfjord seen from public quay. Pump house at left.

immediate possibility of it being harnessed.[30]

Beginning in 1919,[31] a small hydro plant was built at Tårnet about 15 miles northeast of Kirkenes where a 250-foot head of water is carried through a wooden-stave flume to generate about 1000 kVA. (This old plant is shortly to be modernized.) A decade later, a second hydro plant was built at Kobholm on the seacoast 25 miles northeast of Kirkenes and only three miles from the international border. There, a head of about 320 feet is carried through rock-cut tunnels to develop about 2400 kVA. This latter plant can at present only be reached from Kirkenes by sea (Fig. 11).

A third hydro-electric plant was built in 1948–52 at Gandvik about 40 miles northwest of Kirkenes, by a publicly owned company. Of about 5200 kVA capacity, this plant is primarily intended to serve local communities, but it also contracts to provide the mining company with 1000 kVA. The Gandvik plant is linked to another publicly-owned plant at Kongsfjord. A third publicly-owned hydro plant is planned for Neiden, 20 miles west of Kirkenes. To be of 7500 kVA, it may provide some power for use by the mining company.

As has been the case since the mine opened in 1910, the main supply of electricity needed is generated at a steam turbine plant at Kirkenes itself. The present plant was opened in 1951. It has two generators which together produce about 18,750 kVA.[32] This is a completely modern and highly efficient installation. It has been found that Svalbard coal, despite its 10 per cent ash content, serves excellently. Because of the short shipping season, a 25,000 ton stockpile of coal is accumulated at Kirkenes in summer. Cooling of the steam condensers is done by pumping seawater which is always at a low temperature. The cooling water, now heated, is pumped to the concentrator to be used in the ore concentrating processing.

In addition to supplying the mining company, the two hydro plants and one steam plant also help to reduce the risk that communities in the area will be without power in case of a breakdown. The company plants are interconnected with the public system. Such a precaution is particularly necessary because of the long, dark winters and

[30] For details of delimitation and demarcation of the boundary see Trevor Lloyd, *op. cit.*, 1954.

[31] This and other power plants referred to are owned by Sydvaranger Kraftaktieselskap, a wholly owned subsidiary of A/S Sydvaranger.

[32] Technical details are given in Asbjørn Borsting: "The Sydvaranger Story: Electric Power," *Mining World*, Vol. 15, No. 11, Oct., 1953, pp. 69–72. About 45–50 kWh are required to produce each ton of concentrate.

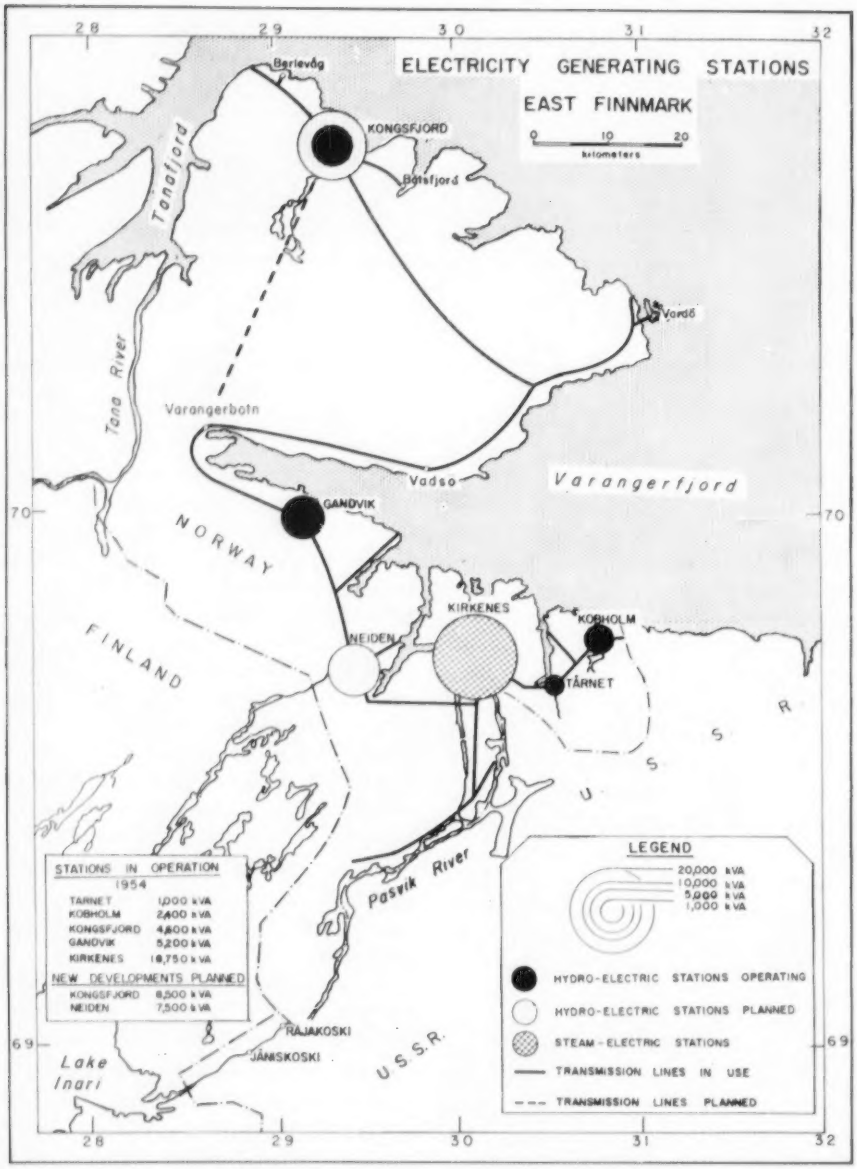


FIG. 11. The main supply of electricity is generated at a steam turbine plant at Kirkenes, but this is supplemented by power from several, small hydro-electric stations near by.

the isolation of the area from other sources of power.[33]

It should be emphasized that, not only in the supply of power, but in many other ways, the isolated Kirkenes region needs to be as self-sufficient as possible. The mining company maintains exceptionally large stores of spare parts, its repair shops are unusually well equipped, and its workmen must be highly skilled and adaptable. Electrical equipment, mining machinery, locomotives, and so on must be overhauled locally because of the delay and expense involved in shipping them the long distance to South Norway. There are, for example, local facilities for retreading the huge ore-truck tires and for the manufacture of oxygen for welding.

PRODUCTION AND SHIPPING OF CONCENTRATE

The capacity of the Sydvaranger plant is about 2.3 million tons of ore per annum, equivalent to 1 million tons of the final product. Following remarkably speedy reconstruction, the first ore was shipped from the mine to Kirkenes in March, 1952, and the first concentrate left the port in mid-May en route to Barrow-in-Furness, England. By the end of 1952, exports totalled 397,843 of the 413,554 tons of concentrate produced. In December of that year 90,000 tons were exported, indicating a rate of about 1 million tons a year.[34] That year's shipment brought to Norway the equivalent of Kr. 36 million (about $5.1 million), all in much needed "hard" currencies, mainly from West Germany and Britain, and a profit on the year's working of about 1.4 million kroner.[35] Assets of the company then totalled about Kr. 180 million. At this time the company employed 1021 persons of whom 831 were workmen at Kirkenes and Bjørnevatn. This did not include temporary labor employed by construction companies. This promising beginning was maintained in 1953 when about 1,750,000 tons of ore were mined to produce very close to the 830,000 tons of concentrate planned. Gross income from selling the product abroad was about Kr. 55 million. Owing to lack of sufficient accommodation to stockpile concentrate in West Germany, only 645,921 tons were actually shipped during the year, although the whole production had been sold in advance.[36] It was because of this delay in shipment that emergency stockpiles had to be made in the open air at Kirkenes. The 1953 export was shipped in 85 vessels going to 13 importers in Germany, Great Britain, and Belgium.—A small shipment of about 1800 tons was sold in Norway.

Although the new plant has not yet reached its full planned production, it is clear from the production data (Table III) that a fairly large quantity of concentrate remains on hand at Kirkenes. The main reason for this (apart from the fall in steel production in West Germany) is that the European market is not able to absorb 1 million tons of the very finely ground type of concentrate Kirkenes produces. Until 1940 a considerable part of the concentrate

[33] In spite of this precaution eastern Finnmark suffered serious shortage in 1953. The main transformer at the publicly-owned Gandvik plant broke down and about two months were needed to repair it. Meanwhile, one of the two Kongsfjord generators was out of service. The mining company could not make up all the deficiency of power.

[34] There is no constant relationship between the amount of concentrate produced each month, and that shipped. A summary of production statistics is given in Table III and Fig. 12.

[35] Financial details are provided in the company's Annual Reports, e.g., *Arsberetning for 1952*, Oslo, 1953, and *Arsberetning for 1953*, Oslo, 1954.

[36] Steel production in West Germany during 1953 was less than had been anticipated when the ore was contracted for in 1952.

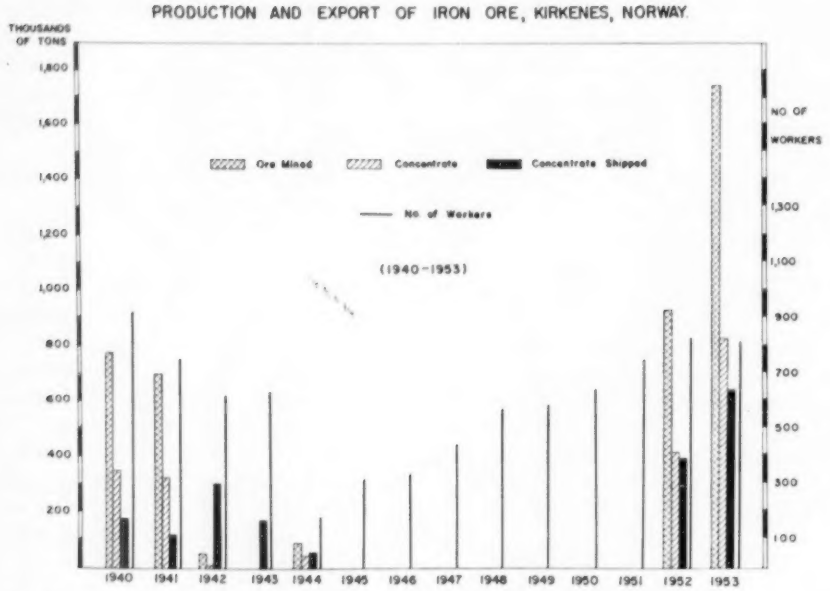


FIG. 12. To produce iron ore again after the war required complete reconstruction, but production and shipments began again in 1952.

TABLE III

PRODUCTION AND EXPORT OF IRON ORE, KIRKENES, NORWAY

1940–1953*

	Number of Workmen	*Mined Ore (Tons)*	*Concentrate (Tons)*	*From Which Produced*		*Shipped (Tons)*	
				Briquettes (Tons)	*Sinter (Tons)*		
1940	928	783,000	356,300	130,400	.....	180,776	1940
1941	753	705,600	323,300	.....	.....	167,792	1941
1942	626	45,600	8,800	.....	.....	301,722	1942
1943	642	.....	.....	.....	.....	171,290	1943
1944	192	85,650	39,700	.....	.....	50,196	1944
1945	312	.....	.....	.....	.....	.....	1945
1946	335	.....	.....	.....	.....	.....	1946
1947	446	.....	.....	.....	.....	.....	1947
1948	572	.....	.....	.....	.....	.....	1948
1949	590	.....	.....	.....	.....	.....	1949
1950	644	.....	.....	.....	.....	.....	1950
1951	754	.....	.....	.....	.....	.....	1951
1952	831	934,300	413,554	.....	.....	397,843	1952
1953	821	1,747,100	832,962	.....	.....	645,921	1953
†1954	930	1,588,000	724,000	.....	.....	668,000	1954

*Provided by A/S Sydvaranger, Oslo: letter of March 9, 1954.

†Information by A/S Sydvaranger, February 11, 1955.

exported was in the form of briquettes (see Tables II and III) which were sold very largely to the United Kingdom. When the new Kirkenes pellet-making plant is in operation this difficulty should be overcome, and it is expected that when 500,000 tons of pellets can be produced annually there will be no difficulty in disposing of the full 1 million tons of concentrate which the plant was designed to produce each year.

During 1954, production fell below the target of 805,000 tons of concentrate, due to labor difficulties during the summer and early fall. Summer vacations (with pay) reduced the labor staff at the mine, as did an unusually large call-up for the military reserve because of large-scale maneuvers in Finnmark. The final totals for the year were: ore mined, 1,588,000 tons; concentrate produced, 724,000 tons; concentrate shipped, 668,000 tons.[37]

The company had contracted in advance to send 700,000 tons of its 1955 production abroad, 200,000 tons to the United Kingdom and the rest to West Germany. About 60,000 tons were to go to the Norwegian steel plant at Mo-i-Rana.

A single shipment of 7000 tons of concentrate was sent to the United States in August, 1952. Regular shipments would of course be particularly desirable since they would bring Norway dollars. Two reasons make this unlikely. One is lack of surplus sintering capacity to handle the ore. This may be overcome when the pelletizing plant at Kirkenes is operating. The other reason is that ore prices, including freight, are somewhat lower in the United States than in Europe. Before 1940 some concentrate went to Poland and Czechoslovakia, but none has been shipped from the new plant.

[37] Data from A/S Sydvaranger, Jan. 11, 1955. A press report (*Sør-Varanger Avis*, Dec. 29, 1954) states that 713,846 tons of concentrate were actually shipped. The difference in the two totals is due to the fact that 6 to 7 per cent of sea water was added to the powdered concentrate to prevent the cargo from shifting while in transit.

CONCLUSION

The reconstructed Sydvaranger enterprise—which literally arose from the ashes—has already brought new life to a region extending south from Kirkenes into the Pasvik Valley, and east and west along the southern shore of Varanger Fjord. Before the war Kirkenes itself had a population of about 4500 with another 1500 people living at Bjørnevatn, and a total of about 10,000 in the area as a whole, more or less dependent on the mine. In 1944 the economic basis of the region had all but disappeared—and with it many of the people. There was very real hesitation as to whether reconstruction of the plant and rebuilding of these various communities could be justified economically.

Today, early in 1955, Kirkenes is approaching complete reconstruction (Fig. 13), and other settlements in the neighborhood are well on the way to being rebuilt. There seems good reason to believe that the mining industry will prosper and may well expand its capacity. A/S Sydvaranger makes a handsome contribution to the Norwegian economy, since it represents at present about one-sixth of the country's mining production, and accounts for perhaps 80 per cent of Norway's iron ore exports and more than 50 per cent of the value of minerals from North Norway's three provinces. Kirkenes furthermore provides an important terminal point on the express shipping route linking ports along the coast of Norway with Oslo. It attracts many tourists every year, and is strategically important vis-à-vis the Soviet Union and the Barents Sea.

There is a natural desire to export

FIG. 13. Postwar Kirkenes seen from the southeast. (Photo: courtesy of NTB, Oslo.)

as much Sydvaranger concentrate as possible so as to secure foreign exchange, but some shipments will be diverted to the new nationally-owned iron and steel plant at Mo-i-Rana when operations start in 1955 and continue until local ore is available.[38]

[38] There is some question about the wisdom of using the premium priced Sydvaranger product for this purpose if cheaper ores are available elsewhere. See K. C. Bockman: "Bergverkdriften i Nord-Norge," *Studieselskapet for Nord-Norsk Næringsliv, Skrift Nr. 5*, Bodø, 1949, especially p. 4. This point was also raised in the local Kirkenes press. See *Sør-Varanger Avis*, April 14, 1954. The company has contracted to supply 60,000 tons of concentrate in 1955, an amount which will rise to about 150,000 tons in succeeding years.

Sydvaranger iron ore production provides an interesting example of natural resource utilization under difficult conditions. In that comparatively remote spot, a combination of Norwegian, Swedish, and German enterprise has during almost half a century built up an efficient system for producing and marketing iron ore concentrates from one of the most intractable ores known. In doing so, pioneer work in mining and processing has produced techniques and equipment likely to prove very useful in other areas where taconites are about to be utilized.

CHANGING PATTERNS OF COAL PRODUCTION IN THE EASTERN INTERIOR FIELD

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THE movements of the center of production of the Eastern Interior coal field provide an excellent summary of the shifts in production which have occurred in this field. The shifts which caused the direction and extent of the movement of the center of production can be identified through analysis of changes in the amount of coal produced in the various counties over the years. An examination of the volume of production for each county helps to focus attention on the major producing areas, and a map showing the intensity of production provides a basis for comparison with published material on other coal fields

Center of Production

The center of coal production[1] in the Eastern Interior Field has moved considerably southward and slightly eastward from its position in 1885 (Fig. 1). Between 1885 and 1914 the center moved 57 miles almost due south. From 1914 to 1952, the period to be considered here in more detail, the production center shifted 30 miles south and 15 miles east. The movement has been from northern Moultrie county in 1885 to central Wayne county in 1952. Throughout this span of years, the center has always been in Illinois.

The trend to the south has been a consistent one except for the decade 1929 to 1939 when there was a brief reversal of direction and a shift northward.[2] In general this southeastward movement of the center of production reflects the early discovery and exploitation of coal in northern Illinois, the later development of railroads and subsequent coal production in southern Indiana and western Kentucky, and the steady increase in importance of production in western Kentucky since 1939.[3] A part at least of the eastward

[1] The technique used in determining the center of production is that described in Raymond E. Murphy and Hugh E. Spittal: "Movements of the Center of Coal Mining in the Appalachian Plateaus," *Geogr. Rev.*, Vol. 35, 1945, p. 626. For a more rapid but less precise method, see John F. Hart: "Central Tendency in Areal Distributions," *Econ. Geog.*, Vol. 30, 1954, pp. 48–59.

The production statistics here used were obtained from the following sources: various editions of the *Minerals Yearbook;* Howard N. Eavenson: "The First Century and a Quarter of American Coal Industry," Pittsburgh, privately printed, 1942; reports by the State Geological Survey on Illinois Mineral Industry; material from the Coal Trade Association of Indiana; and information courteously provided by the Kentucky Geological Survey.

[2] One other minor exception occurred in the single year 1927 when the center of production jumped to a position just south of the 1952 center. This was abnormal, however, and was due to a strike in Illinois referred to as Lewis' Jacksonville Agreement. At that time Kentucky mines were not unionized, and production there increased tremendously to take advantage of the situation. (Information from Mr. D. J. Jones, State Geologist, Kentucky Geological Survey.)

[3] Only a few very tentative explanations are advanced for the changes described in this paper. Very little has been published on the location of production in the Eastern Interior Field, and a great deal of further research is necessary before many of the changes can be accounted for.

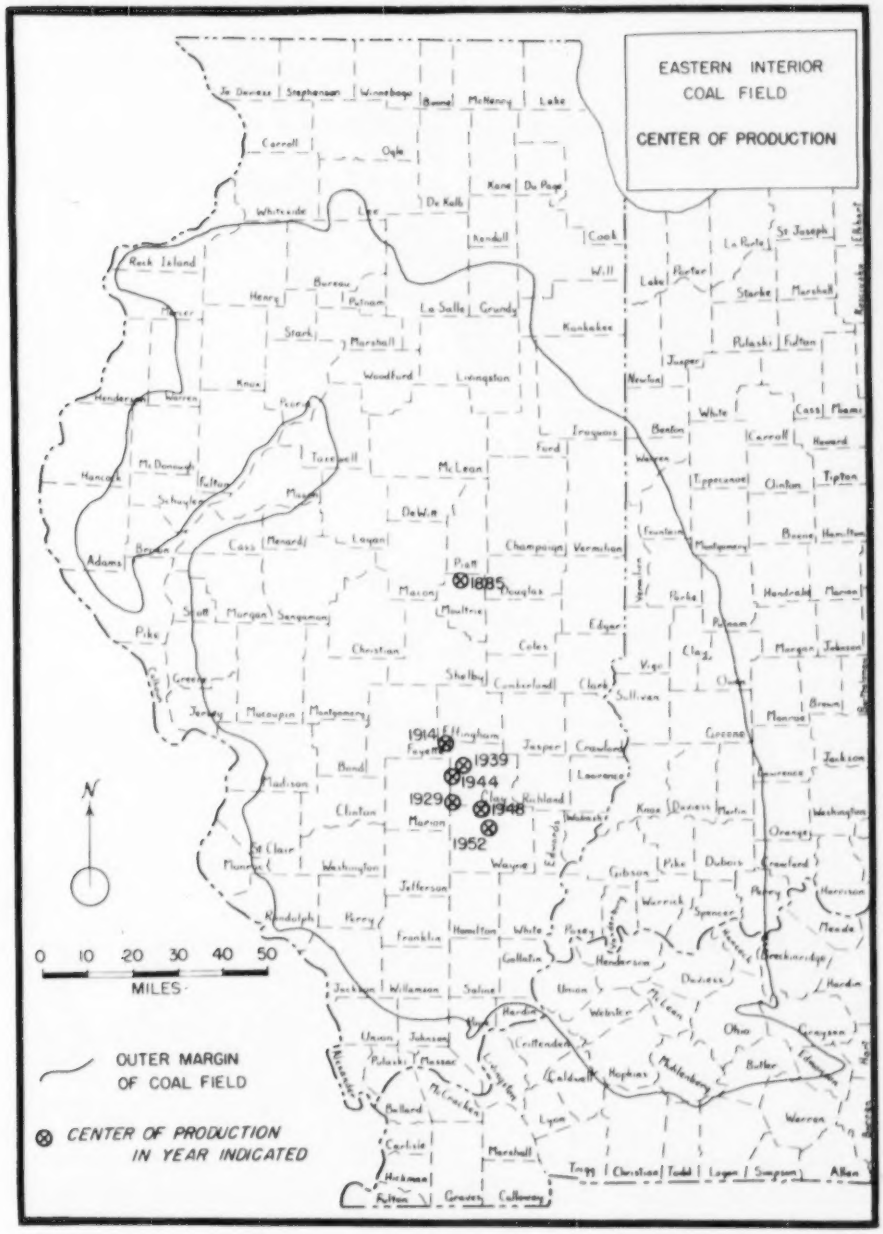

FIG. 1. The movement of the center of coal production in the Eastern Interior Field has been predominantly southward.

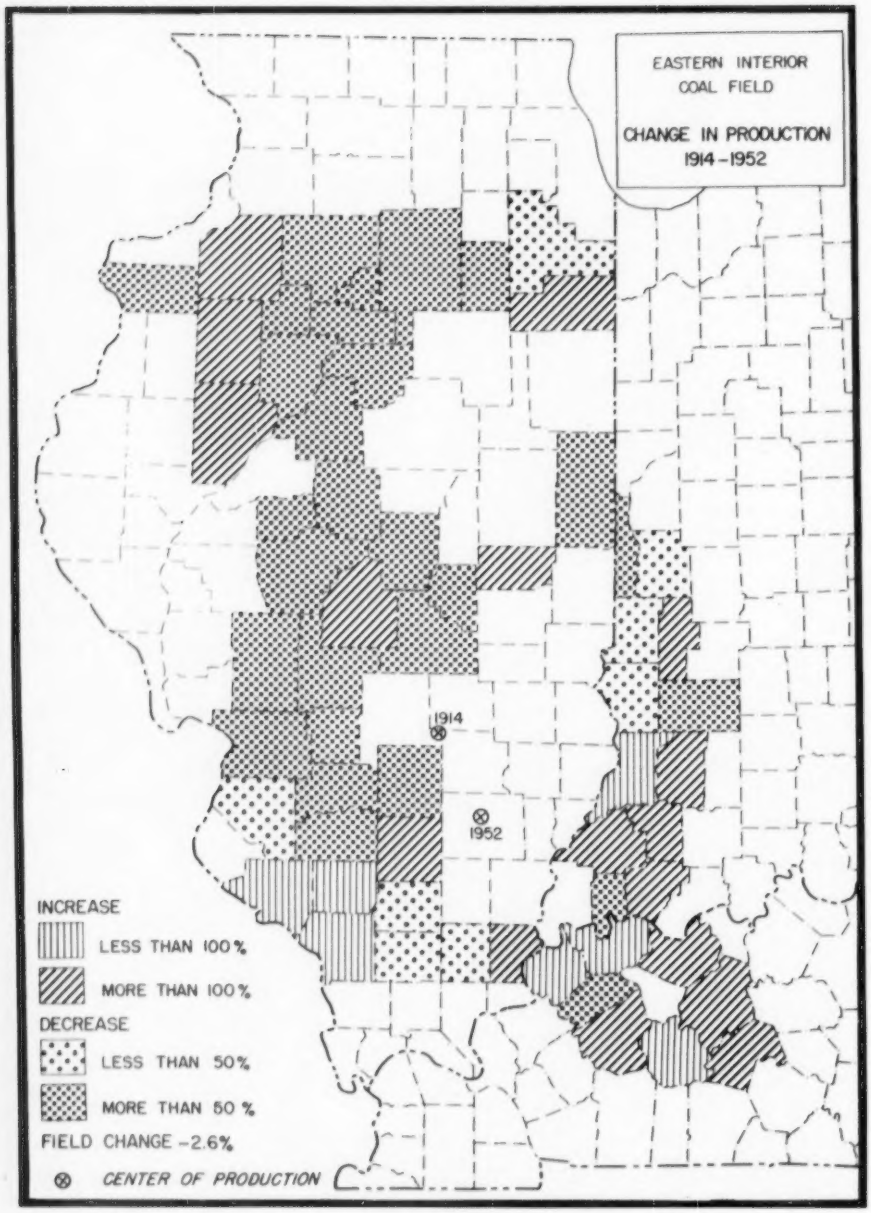

FIG. 2. Comparison of 1952 production with that of 1914 shows increases in most of the western Kentucky and southwestern Indiana counties and decreases in most of the counties north of the latitude of the 1914 center.

movement results from the recent emphasis on strip mining, a system more important in both Indiana and Kentucky than in Illinois.[4] It is interesting to note that as the national center of coal production moves west and south,[5] the center of production of the Eastern Interior Field is moving south and east toward it. This southward and eastward movement, however, is taking the center of production of the Eastern Interior Field farther away from the national center of coal resources which is estimated to lie near Kearney, Nebraska.[6]

COUNTY PRODUCTION CHANGES

Between 1914 and 1952 the total output of the Eastern Interior coal field changed very little, a decrease of less than 3 per cent, yet a considerable movement in the center of production occurred. It can be seen from Figure 2 that this movement resulted primarily from large-scale decreases in production in 18 Illinois counties north of the 1914 center, and production increases in all but one of the counties of western Kentucky.[7] Contributing to the southward trend is the fact that all but one of the counties in Indiana north of the 1914 center showed decreasing production and all but one to the south showed increasing production. The overall movement did not take place at a constant rate, however, so it is desirable to examine the changes in production occurring over shorter periods in order to establish the timing of the major shifts.

The 1914–1952 period may usefully be split at 1929 into two periods, each showing relatively little change in the total production of the field but considerable movement of the center of production. The 1929–52 span needs to be further subdivided to examine several shorter periods showing differing trends of considerable magnitude in both total production and movement of the center of production.

From 1914 to 1929 there was almost no change in the total output of the field (Fig. 3), although there was a considerable shift in the center of production. This means, of course, that despite the constancy of total field production, significant changes in the distribution of production took place. The major county changes in production from 1914–29 were the general decreases in Indiana and increases in Kentucky. There was no consistent pattern of change in Illinois, adjacent counties often showing opposite trends, except for major decreases in a bloc of five counties in north-central Illinois.

Most of that small change in total production which did occur between 1914 and 1952 took place after 1929, but during this latter period the center of production moved a shorter distance than in the 1914–29 span just discussed (Fig. 4). In other words, after 1929 the changes in production were somewhat more evenly distributed than in earlier years. Between 1929 and 1952 the three northwestern counties in Illinois increased production considerably,

[4] In 1948, only 27 per cent of the production in Illinois was by strip methods as compared with 48 per cent in Kentucky and 58 per cent in Indiana. *Minerals Yearbook, 1949.*

[5] See Raymond E. Murphy: "Wartime Changes in the Patterns of United States Coal Production," *Annals Assn. of Amer. Geogs.*, Vol. 37, 1947, p. 194.

[6] F. G. Tryon and W. F. McKenney: "Geographical Shifts in Coal Production," *Coal Age*, Vol. 19, No. 3, Jan. 20, 1921, pp. 106–107.

[7] It was felt that the change in a county's production and a comparison of that change with the change in production of the field as a whole allowed more significant comparisons than the percentage-point change method much used in recent geographical papers. To eliminate insignificant changes, only counties producing at least 100,000 tons in one of the terminal years are shown on each change map. All production was used, however, in determining *centers* of production.

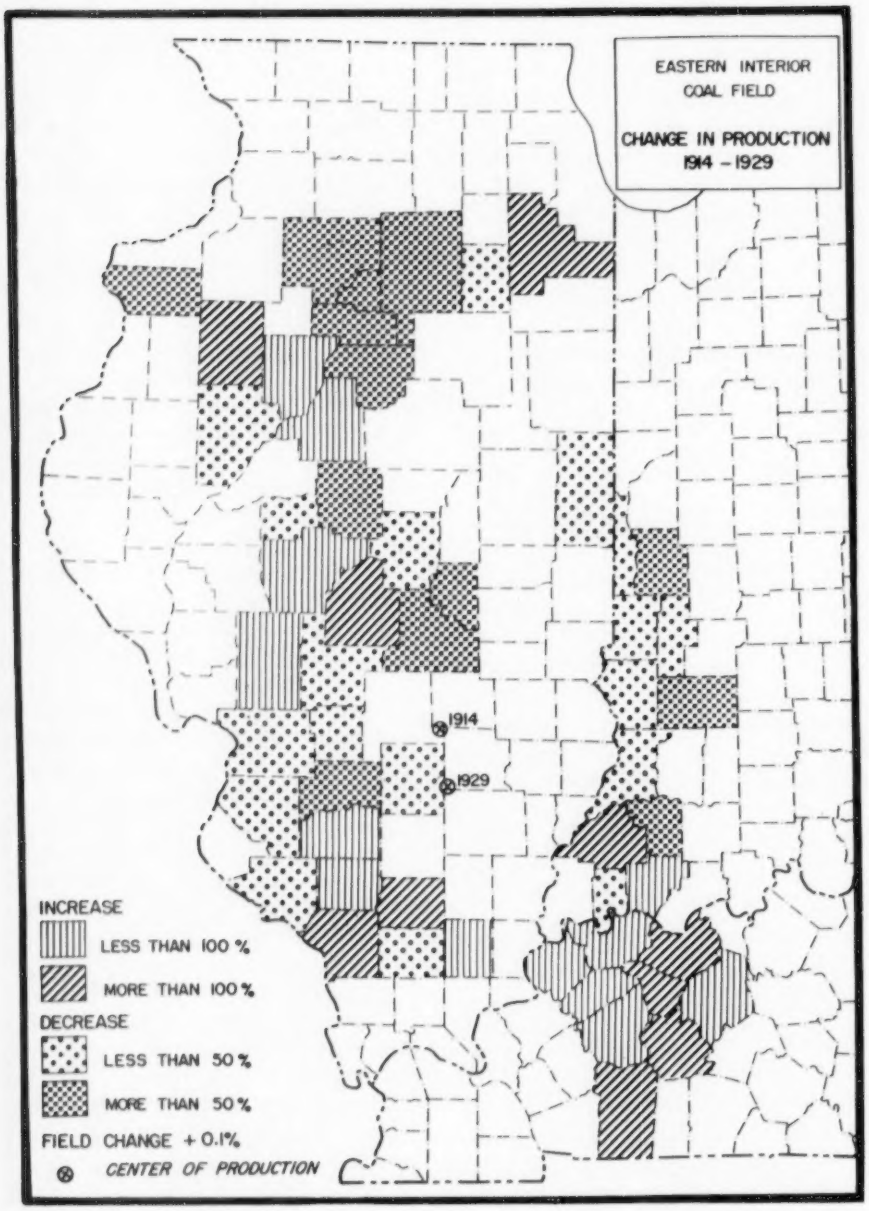

FIG. 3. The most significant changes brought out by the comparison of 1914 and 1929 production are general decreases in Indiana and increases in western Kentucky.

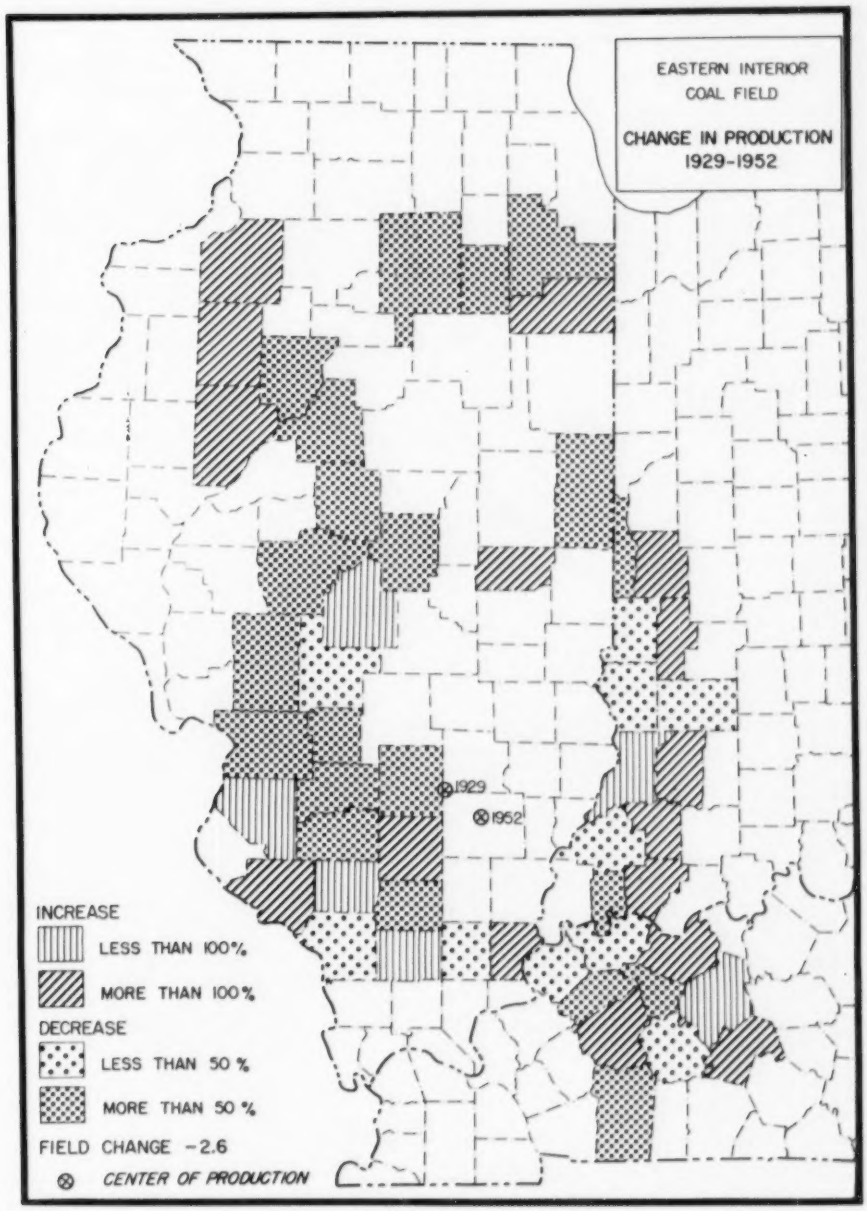

FIG. 4. The shift of the center revealed by a comparison of 1929 and 1952 is more eastward than southward, reflecting increases in the eastern tier of producing counties in Indiana and some increases in western Kentucky.

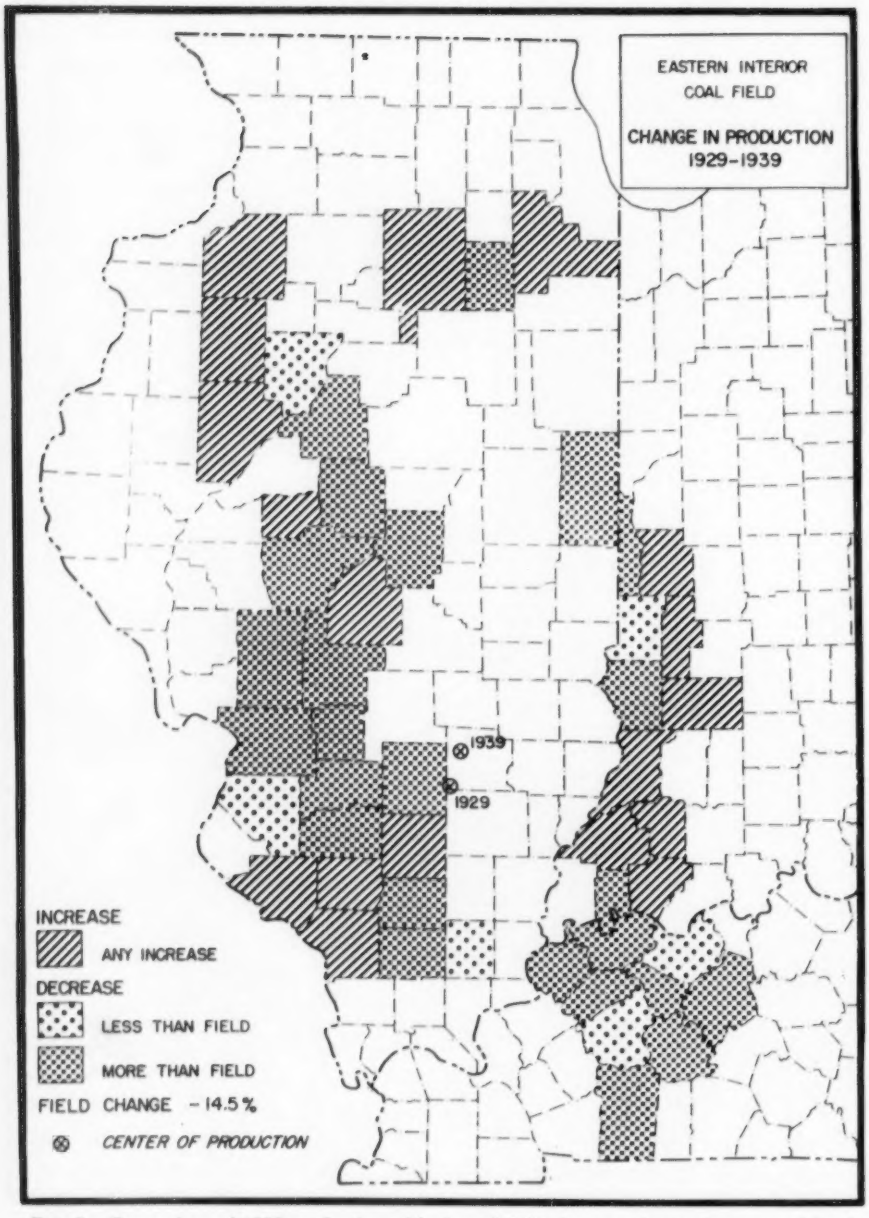

FIG. 5. Comparison of 1929 production with that of 1939 shows an interesting reversal in the movement of the center, apparently associated with retrenchments during the depression years.

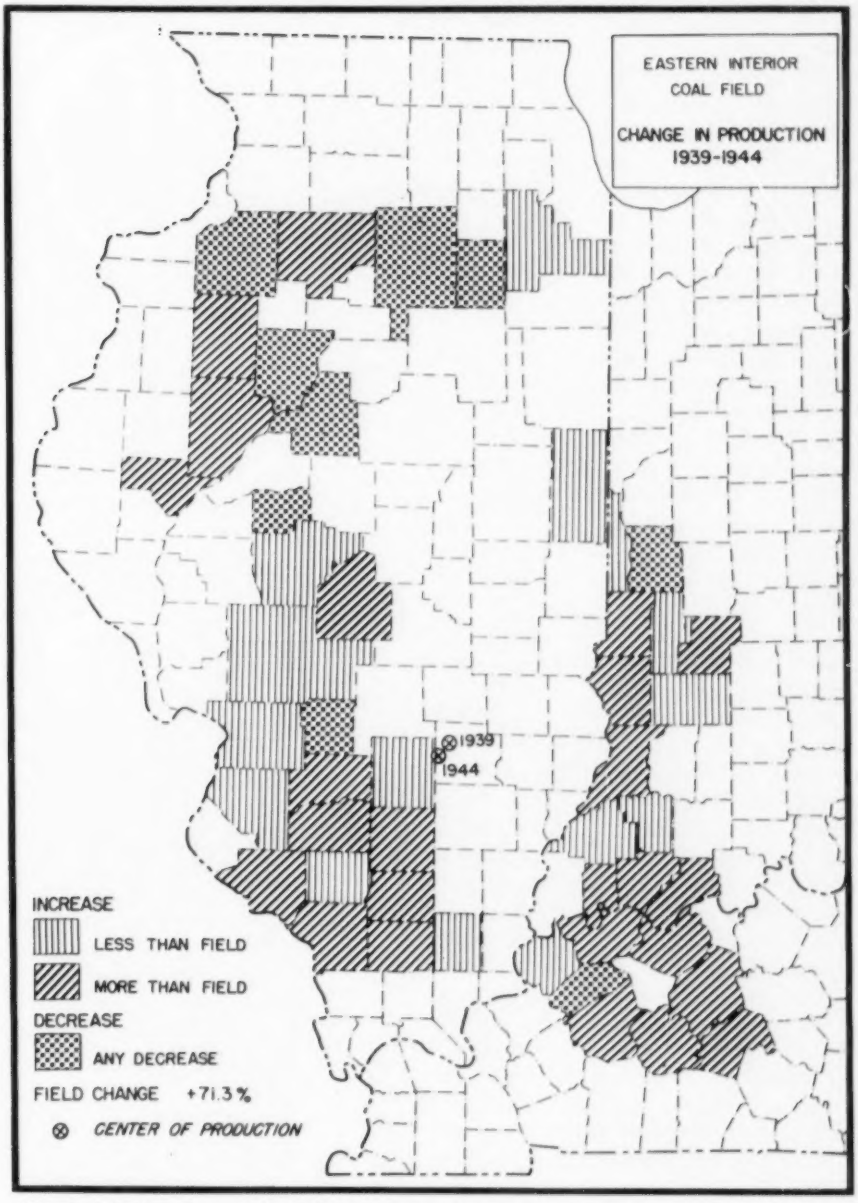

FIG. 6. The large increase in production during the war years was rather evenly distributed and hence finds little reflection in movement of the center.

but the general pattern in the state was one of decreasing output. The southward and eastward movement of the center of production largely reflected the increases of more than 100 per cent in the eastern tier of producing counties in Indiana and a few major increases in Kentucky.

A further breakdown of the 1929–52 period shows that there were short-term changes of considerable magnitude in the production of the field as a whole, although the net change in production, as has been pointed out, was very small. From Figure 5 it is apparent that during the depression decade, 1929 to 1939, production in Kentucky decreased more sharply than in either Illinois or Indiana. In fact, a number of counties in Indiana, a bloc of four counties in southern Illinois, and five counties in northern Illinois actually increased output during this period of reduced demand. The net result of these gains and losses was a retreat of the center of production to the north during this decade. The considerable increase (71 per cent) in total production of the field during the 1939–44 war period was rather evenly distributed (Fig. 6), and the center of production moved only a short distance. The only important exception to the general pattern of increased production was five counties in northern Illinois in which production decreased even during this period of unlimited demand. By 1952 production had declined by one-third from the high level of 1944 and the center of production had resumed its movement to the south and east (Fig. 7). Only eight of the 29 producing counties in Illinois showed an increase. In Kentucky, four of the eight producing counties increased production and two more decreased less than the field. The pattern in Indiana, like that in Illinois, was generally one of major decreases.

VOLUME OF PRODUCTION

Production in the Eastern Interior coal field is concentrated in a relatively few counties. There are only 54 counties which in 1952 produced more than 10,000 tons, and 23 of these produced more than a million tons each (Fig. 8). An additional seven counties each had an output of more than 500,000 tons. These 30 counties produced 96 per cent of the field total, and it is noteworthy that the 23 counties which mined over a million tons each, together accounted for about 90 per cent. The concentration of production is slowly but steadily increasing. In 1914 the million-ton counties (24) produced 86.4 per cent of the field total, in 1929 the 22 million-ton counties accounted for 88.5 per cent of the total, and in 1952, as noted above, the counties in this class produced 90.5 per cent of the output of the field.

The counties producing more than a million tons a year—obviously, those having the greatest effect on the center of production—lie in five distinct groups. The Kentucky group is made up of just three counties—Hopkins, Muhlenberg, and Ohio; but Hopkins alone, by far the field's largest producing county, has an annual output of almost 13 million tons per year. The Indiana group is made up of a row of counties from Warrick in the south to Vigo in the north. Three of the high-production groups are in Illinois: one in the south, centered on Williamson and Franklin counties; another in western Illinois, extending from St. Clair county to Christian county; and the third in the north, consisting of Knox and Fulton. The center of production lies almost in the middle of the first four of these groups. Since 1929, the Kentucky and Indiana groups have increased production, whereas the western Illinois and southern Illinois groups have decreased

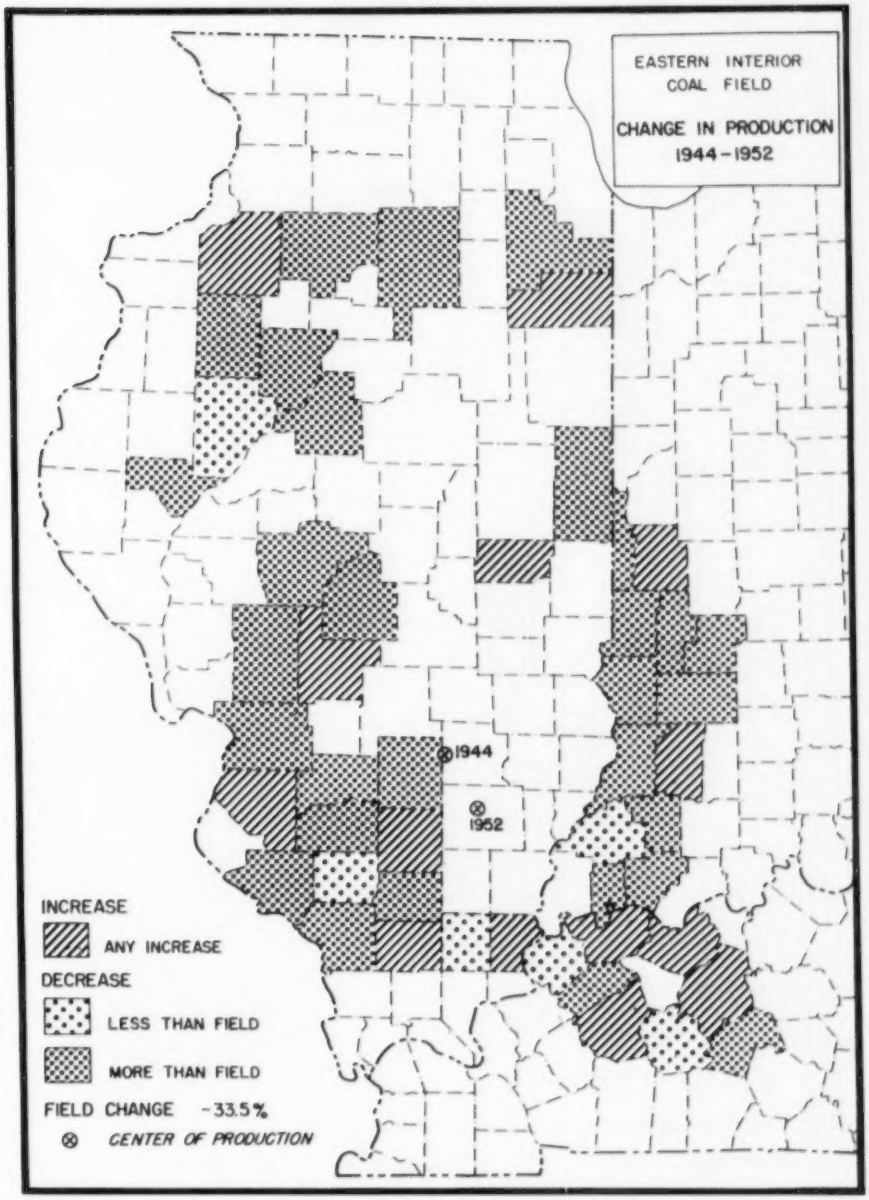

FIG. 7. Comparison of 1944 with 1952 shows a resumption of the movement of the center of production to the south and east.

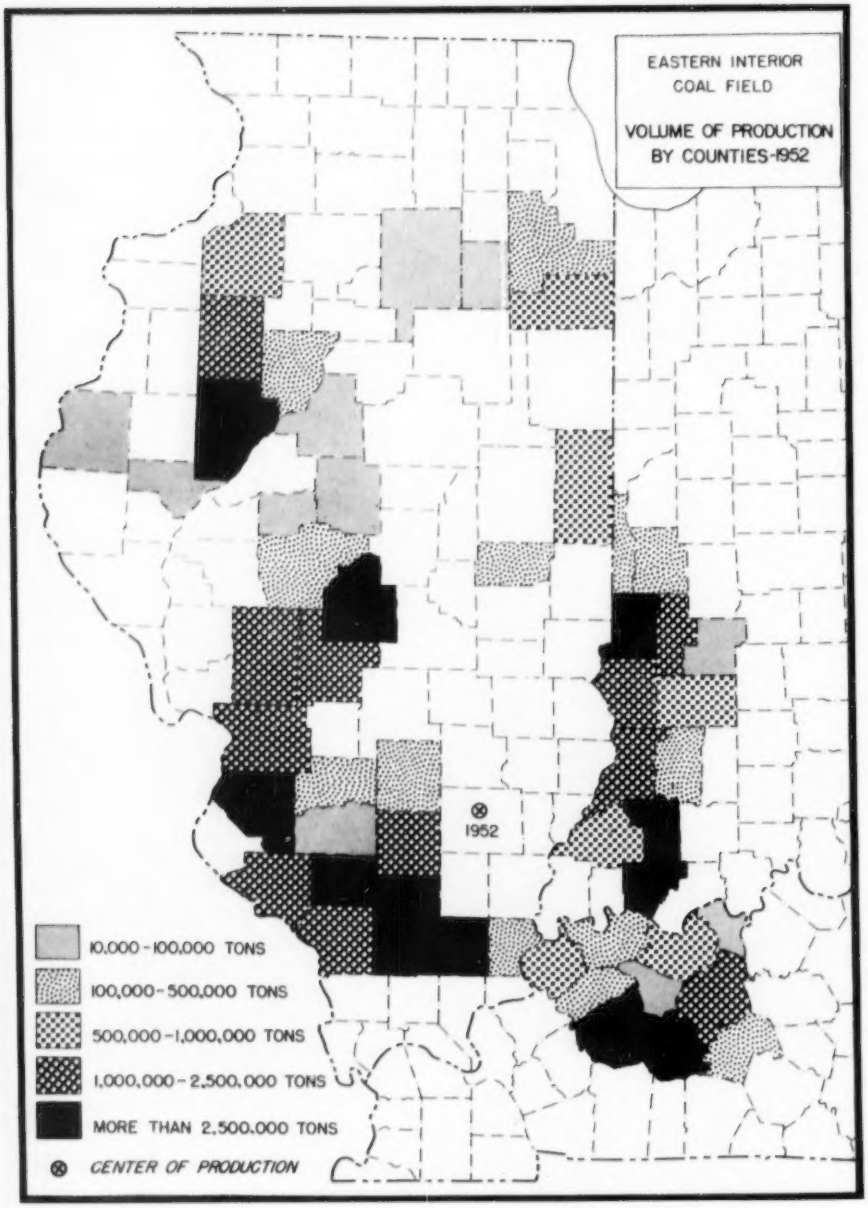

FIG. 8. Twenty-three counties produced 90 per cent of the total in 1952.

production. The group in northern Illinois also increased production, but the volume there is much smaller. It should be noted, however, that the group of high-production counties in northern Illinois exerts a greater influence on the center of production than the relative volume of their output would indicate. This is due to the fact that the center of production is actually a locational mean, and like all means it is greatly influenced by extremes (in this case, extreme distance).

INTENSITY OF PRODUCTION

Few of the counties in the Eastern Interior coal field reach a really high intensity of production, at least not as compared with counties in the Appalachian Field[8] (Fig. 9). There is apparently an actual difference in intensity, since there is little difference in the other variable—county area.[9] In the Eastern Interior Field there is no county with an intensity of production greater than 30,000 tons per square mile and only one with more than 15,000 tons per square mile. In the Appalachian Field in 1939, on the other hand, there were at least two counties producing more than 30,000 tons per square mile, and a total of 12 producing more than 15,000 tons to the square mile.

The intensity of production map seems to be rather less useful in studying the Eastern Interior Field than Murphy and Spittal found it for the Appalachian Field. All of the salient features of this map can be discerned equally well on the map showing volume of production. (A greater number of classes on the volume map would have made the correspondence even closer.) One reason for the relative correspondence of the two maps in the case of the Eastern Interior Field is probably a smaller variation in county size than occurs in the Appalachian Field.

In spite of the fact that the intensity map adds little to the conclusions reached from the volume map of the Eastern Interior Field, the intensity map may have considerable utility. Its usefulness lies in the fact that it employs the same classes and is computed in the same fashion as the map of the Appalachian Field previously published by Murphy and Spittal; therefore, the two maps are easily comparable.[10] This comparability is the reason for including the intensity map in the present study.

The body of directly comparable material covering different areas is not likely to grow very swiftly if it must be made up of entire studies covering precisely the same aspects of two areas. In many research jobs, however, at some stage the information is in such a form that some part of it can relatively easily be put in a form directly comparable with part of a published study. If geographers will be alert for such situations and will make the slight extra effort involved, they can steadily contribute to the accumulation of a body of comparable information without attempting to mold new research into the exact patterns used in the past.

SUMMARY

The center of production in the Eastern Interior coal field has been moving steadily southward and eastward. This reflects the increasing importance of western Kentucky and southern Indiana

[8] For intensities in the Appalachian Field see Raymond E. Murphy, and Hugh E. Spittal: "A New Production Map of the Appalachian Bituminous Coal Region," *Annals Assn. of Amer. Geogs.*, Vol. 34, 1944, pp. 164–172.

[9] The counties in the Appalachian Field actually average slightly larger than those in the Eastern Interior Field. The average size of all coal-producing counties in Illinois, Indiana and Kentucky, is 522.2 sq. mi., and the average of coal counties in Pennsylvania, Ohio and West Virginia is 581.4 sq. mi.

[10] See Murphy and Spittal, *op. cit.*, Fig. 3.

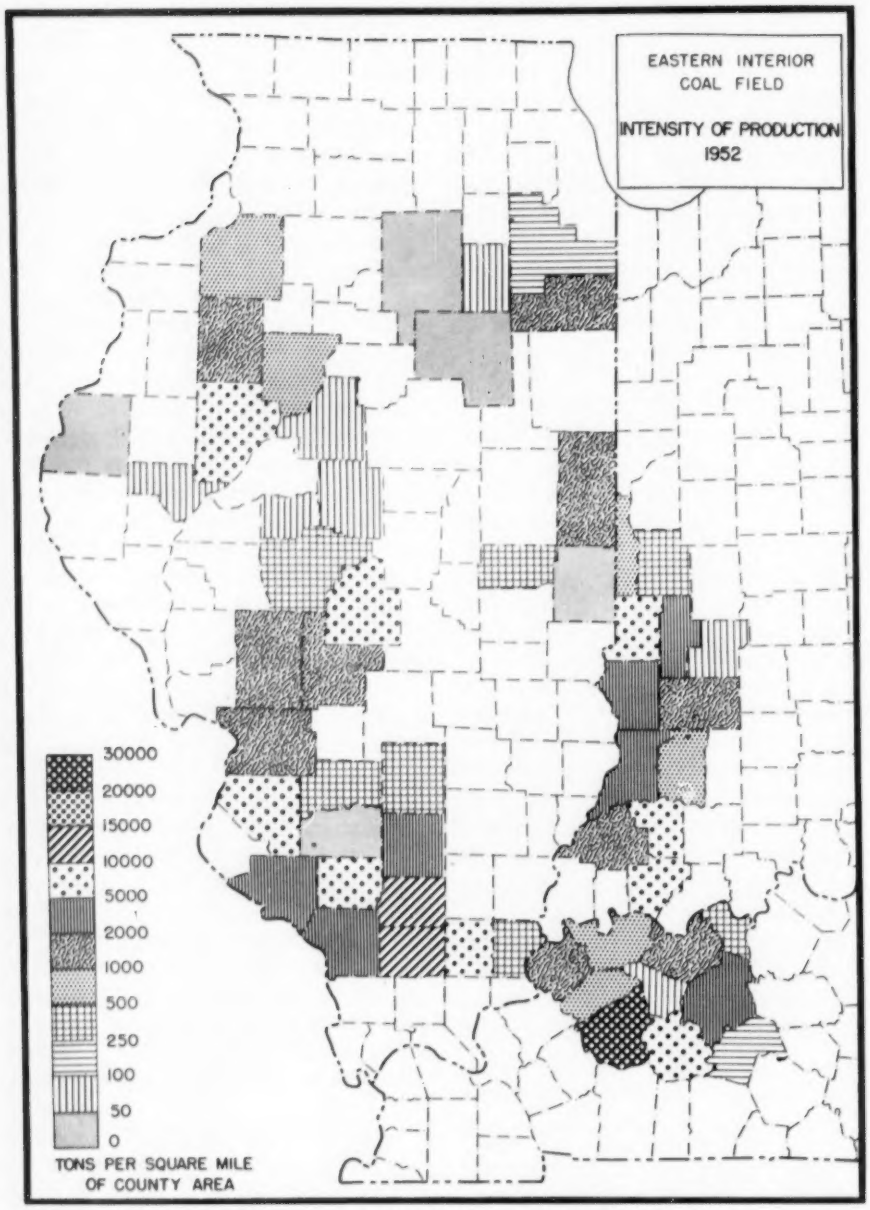

FIG. 9. For the Eastern Interior coal field the pattern revealed by the intensity map is little different from that of volume of production, Figure 8 of this series. This map should be compared with Figure 3 in Murphy and Spittal's article, *op. cit.*

and the decreasing importance of northern Illinois. Most of the production of the field comes from a relatively few counties; these counties are clustered in five groups, with the present center of production—located in southeastern Illinois—surrounded by four of the five high-production groups. These groups may be identified from either volume or intensity maps, since there is little variation in the Eastern Interior Field between the patterns of volume of production and intensity of production. This paper has located and timed the major changes in the pattern of production, but further research is necessary fully to explain the causes of the changes described.

RIVERINE AND COASTAL JUNKS IN CHINA'S COMMERCE

Herold J. Wiens

Dr. Wiens, Associate Professor of Geography at Yale University, spent many years in China and specializes on that area in his research.

RAILROAD development in China still is restricted to a few lines, between which are great expanses that are 100–200 miles from any rail connection. Furthermore, motorized highway transport is commercially prohibitive for handling the bulk needs of the Chinese masses. Land transport, especially in hilly southern China, is both inadequate and costly. Wherever rivers have navigable channels, therefore, river boats provide relatively cheap transport and are of great economic importance.

For over 2000 years the wooden Chinese river boats, commonly referred to by Occidentals as "junks," have filled an important role in China's riverine commerce. Coastwise transport has been handled by Chinese junks of great seaworthiness for a somewhat shorter period of history. Whereas the introduction of steam and motor shipping into Chinese coastal and river traffic has led to a greatly diminished role for Chinese junks, the significance of junk-borne traffic is still considerable. With Communist China suffering a serious shortage of modern merchant vessels, the significance of junks in China's transport system has been enhanced during the last few years. This study proposes to examine the Chinese junk traffic and its centers of activity during the last century; to estimate junk sizes, capacities, and numbers; and to evaluate its regional significance as well as its national significance in Communist China, today.

Early Development and Trends

Marco Polo stated that official reports of his time (13th Century) indicated the number of boats ascending the Yangtze River annually through a particular customs post reached 200,000. Although this statement does not give a reliable clue to the actual number of boats in operation, it does point up the significance of junk shipping in China's economic history. In coastal and oceanic as well as riverine trade, Chinese junks were active at a very early date. As early as the 5th Century, Chinese trading junks were visiting Indonesia and sailing to far-off India.

By the beginning of the 19th Century, a very large number of Chinese junks were engaged in the coastal trade between Chinese ports. Proof of this is found in the fact that when the Imperial Government at Peking found it necessary to transport its rice from the Yangtze Valley by sea routes, rather than via the Grand Canal, because of channel shifts in the Yellow River and because of the T'ai-p'ing Rebellion, it was able to obtain commercial carriage for some 80,000 tons of rice annually from Shanghai to Tientsin, apparently without disturbing normal trading demands. It was estimated in 1843 that, at this time, there were 14,000 to 20,000

Shanghai junks engaged in the northern traffic alone.

The regime of the East Asiatic monsoon winds had important effects and limitations upon this junk traffic. During earlier centuries, the influence of this climatic situation established the custom that brought the sailing fleets northward in spring, so as to take advantage of the northwest monsoon winds on the return trip. The trip, according to Bidder, required 20 days each way.[1] (This seems rather high in comparison with Donnelly's figure of six or seven days for the trip between Shanghai and An-tung by the An-tung Trader, which he describes as, "at best a slow moving and clumsy craft."[2] The 20 days, however, may include loading and unloading and a rest period at each end, i.e., the actual commercial trip time, rather than the sailing time.) Bidder states further, however, that the trading ships annually could make three to four trips. The ship owners were greatly concerned about proper scheduling, loading, and unloading, so that they would not miss favorable winds and thus be able to make "only two trips north with cargo in one year."

The ideal schedule for the merchants provided that the grain in the south should be loaded on the ships so that they could sail by the first month (February in the Western calendar) for Tientsin, reaching there as soon as the ice was broken up. By April 20, all junks should be sailing with empty holds for the Liaotung Peninsula for a load of bean cake (fertilizer), returning south by the 21st of May to load rice again. By June 21, they should again be on their way north, unloading at Tientsin by the 7th of August. Another month was involved apparently in waiting for the rice to get to T'ung-chou near Peking by canal. (The rice appears to have been transshipped on smaller vessels from Tientsin; so the reason for the wait by the large junks is not clear.) By September, the empty vessels again would have reached Manchuria for another load of south-bound cargo, which should reach the southern ports within a month. This schedule would give them time to make another trip north as far as the Shantung vicinity, so that they could return south near the end of the year to load rice for the following spring trip northward. Ships with rice arriving late off Tientsin in the fall were forced to lie up for the winter in Taku because of the ice on the Hai Ho (river) and could go only upstream to unload after the ice broke up in the spring.

Steamship competition was developing rapidly, and by 1873 part of this northern rice haul was done by steamers. Eventually, steamers were to displace the junk in this traffic almost entirely. The steamship not only had the advantage of large cargo space and of speed over the junk, but it was not governed by the winds and was less concerned by ice problems.

As far as interior distribution from Tientsin and commodity carriage to Tientsin was concerned, in 1902 junk routes still accounted for 68 per cent of the inland trade, the total value of which was put at about 22 million Haikuan Taels (ounces of silver with a fluctuating value, which in 1922 were worth about U. S. $0.83). The railroads leaving Tientsin then carried only about 24.35 per cent of the trade with the interior. The percentages carried by various routes are shown in Table I.[3]

[1] H. Bidder: "Das Seetransportwesen der Chinesischen Regierung, Schmollers Jahrbuch," 1921, pp. 153–160.

[2] Ivon A. Donnelly: "Chinese Junks and Other Native Craft," Shanghai, 1924, p. 48.

[3] China Imperial Maritime Customs: "Native Customs Trade Returns, No. 2," Tientsin, 1902. Shanghai, 1904, p. 3.

TABLE I

INLAND TRADE OF TIENTSIN, 1902

Routes	*Percentages*
Railway	24.35
Grand Canal	18.92
Hsi Ho (Pao-ting River)	31.41
Pei Ho	7.54
Hai Ho	3.75
Tung Ho (Lu-tai Canal)	6.39
Land roads	3.25
Other routes unspecified	4.29
Total	100.00

Moreover, junks were faced with a formidable array of licenses and taxes not faced by the foreign steamer entering treaty ports. At Tientsin there were nine different tax or license officers to which junk traffic had to submit. The Acting Deputy Commissioner of Customs at Tientsin in 1907 wrote, "The trouble and expense of navigating junks and their cargoes through all these difficulties are so formidable that in the opinion of the junk people they are slowly but surely dealing the *coup de grace* to the junk trade of Tientsin."[4]

That the junk was not bound to disappear was indicated by the Commissioner of Customs at Chefoo in 1907 as recorded in the same volume:

> The advent of inland waters steamers does not mean the doom of the junk trade; there is room for both. The places on the coast to which steamers can ply are limited, and our shallow, bar-guarded harbors are better suited for the flat-bottomed junks, that are the result of hundreds of years of experience of the difficulties they have to encounter. Just as in Europe, barges compete, and under proper conditions successfully compete, with steam-driven craft, so may we expect for years to come to see the picturesque junk in her own leisurely way make a success of the trade for which she is so well suited.

Two reports of 1933 give indications of what was happening to the junk traffic of Manchuria at that time. On the T'u-men and Hung-ch'ih Rivers, the existence of junk traffic was being imperiled by the advent of the new Korean Railway from Yu-chi. It was estimated, however, that there still were about 100 junks engaged in the carriage of goods between Hun-chun and various points along these rivers. On the Sungari, the Harbin Customs Office reported that although the Harbin fleet had been well maintained with regard to steamers and barges, there had been a great falling off in junks. Practically no new junks were being built, and, although some had been incorporated into the towing fleet, great numbers of them had been broken up or lost. By the end of the decade (1922–1931) the number had fallen to 551.

At Shanghai during the same period, the Commissioner wrote that the junk traffic had, year by year, shown a downward trend despite efforts made by the Government to foster the trade (Table II). This he considered regrettable, since he thought it more than probable that, were it not for the prevalence of piracy, the junk trade would still be able to hold its own against steamers, especially in carriage of such commodities as poles, stones, sand, bean oil, kerosene oil, and certain dangerous goods. Another factor which militated against the revival of the junk trade was the greatly enhanced cost of construction and replacement. In 1921 a seagoing junk, say of 300 tons, could be constructed for $10,000. In 1932, because of the rise in the cost of labor and materials, a sum of from $18,000 up to $20,000 had to be paid. (Although not so specified in the account, these sums probably were in Chinese dollars which fluctuated in exchange with U. S. dollars between par and three to one during the course of the decade.)

Inland from Shanghai, at Soochow, the Customs report in 1931 stated that with the keen competition of the rail-

[4] *Ibid.*, "No. 3, Quinquennial Reports and Returns 1902–1906," Shanghai, 1907, p. 9.

TABLE II

DECLINE OF SHANGHAI'S JUNK TRAFFIC*

	1922	1930
Trade value in HK Taels	87,651,111	114,017,058
Number of junks entered and cleared	57,482	54,410
Number of steamers entered and cleared	4,479	23,790
Steam tonnage entered and cleared	1,672,208	3,858,163

*China Maritime Customs: "Decennial Reports," *op. cit.*, Vol. 2, p. 53.

road and the sailing junks, the launch traffic between Soochow and Shanghai was in a very poor condition. It would seem from this that the junks were still holding their own there. At Amoy, the Customs officer reported that the junk traffic continued to make headway (during the decade 1922–1931) in spite of all the difficulties and dangers frequently met.

On the other hand, in the reports from Swatow during this period one finds a note of gloom. Describing the increased use of mechanically operated ships here, the report states: "The decennial increase over the preceding decade's shipping of some 12,274 vessels and 20 million tons signified the expansion of Swatow's trade. The development of oil-burning and motor vessels was most marked; they increased from 62 in 1922 to 124 in 1931. In 1922 they were used only for inland trade, but their use for coastal work greatly increased in the latter period. Much of this expansion is due, however, to the gradual extinction of junks as coastal carriers because of their vulnerability to pirates."[5]

At the Kowloon Customs opposite Hongkong there was a new note of interpretation about an apparent revival of junk trade. The junk register showed that the number of junks entering and clearing at this post had declined by over 3000 between 1922 and 1931, but the 1931 figures were the highest since 1924. Probably the truth was that junk traffic was declining, but had been put on its legs again by the high import tariffs of recent years, which put a premium on smuggling, for which junks were very well suited.

[5] *Ibid.*, "Decennial Reports," Vol. 2, p. 156.

JUNK NAVIGATION AND TRADE ON THE YANGTZE

If interport trade registered by the Native Customs gives a reliable indication, some 56 per cent of the domestic trade carried by water occurs along the Yangtze trunk line and tributaries between I-ch'ang and Shanghai. It is important, therefore, to study the situation along the Yangtze. Spencer gave what is probably a fairly accurate summary of the situation existing in 1938. "Old style native shipping," he wrote, "has not been totally eliminated, but its volume has decreased tremendously, and much of it has been relegated either to small unit movement between ports not connected directly by steam or to those waters totally or seasonally out of reach of steam launches."[6] In another article, he indicated that it was unlikely that steam would penetrate very far beyond its present limits of navigation, leaving a realm to the native boatmen.

In evaluating the effect of steam competition, the Decennial Reports of the Customs pointed out that native junks with their slow, uncertain, and

[6] J. E. Spencer: "The Junks of the Yangtze," *Asia*, Vol. 38, 1938, pp. 469–470.

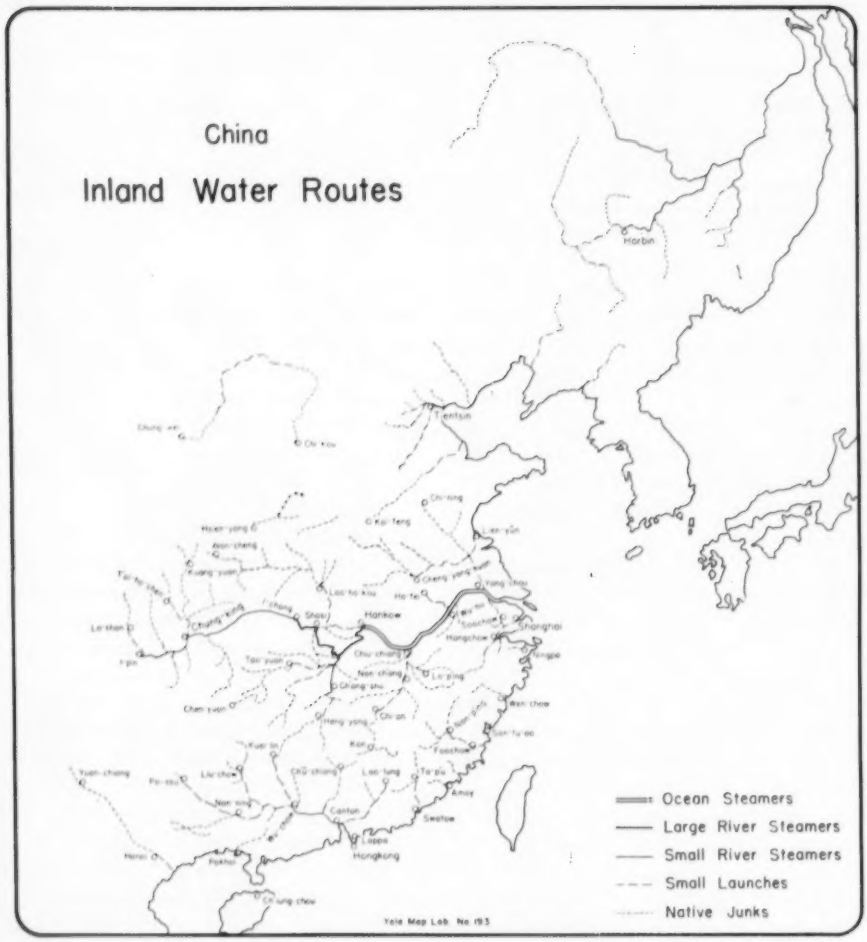

FIG. 1.

unsafe return passage, beating upstream, could not compete even with the small handy foreign schooners and brigs, much less with steamers. So difficult was the return journey that in many cases it was the custom to sell the junk for what it would fetch at the end of the downstream passage. Spencer indicated that the inland junk, needing no protection against waves, had but little freeboard. This often meant a ruined cargo or a swamped and capsized junk, since the passage of a steamer created a sizable wash of water. From the commercial shipper's point of view, the safer service rendered by steam and motor vessels proved a good recommendation in attracting freight.

At the beginning of the 20th Century, the most modest estimates,[7] according to Bon d'Anty, gave 10,000 junks to-

[7] The data for the following account is largely derived from Wang Chung-chi, "La Navigation du Yangtseu," Paris, 1932, pp. 238–282.

talling 400,000 tons capacity for the Yangtze navigation upstream from I-ch'ang. The largest junks in this sector of the river were 80–120 feet long and 9–12 feet wide, carrying loads of 40–100 tons. The medium-sized junks carried 30 tons on the ascent and only 15–20 tons on the descent. The smallest junks on the run carried about ten tons.

In general, the junk crew on the Yangtze comprised a captain, a manager (sometimes the owner was both), four oarsmen, and a cook and handy man combined. On the Upper Yangtze between I-ch'ang and Chungking the crew included a captain, two quartermasters, a pilot, a helmsman, a cook, and a chief of trackers, plus some trackers, the number of which depended upon the size of the junk and the length of its journey. Downstream from I-ch'ang only six to ten trackers were required. Above I-ch'ang at all the rapids, relays of supplementary coolies were posted who were employed to help haul the junks over the swift and dangerous currents. On the ascent, junks carrying 60–70 tons of cargo required over 150 trackers; those carrying 30–40 tons required about 100 trackers; those carrying 14–20 tons required about 60 trackers to get them over the rapids. Hiring of trackers in the past has been through gang-chiefs.

The most active period of navigation by junks through the Upper Yangtze is the low water period during the first three months of the year. During the second quarter there is a decrease in activity, coming to a virtual halt during the period of high water from June to the end of August. Only a few junks traveling downstream move along the river during this season, because the swift waters of the gorges and rapids are dangerous. The low water period is the safest because the important rocks

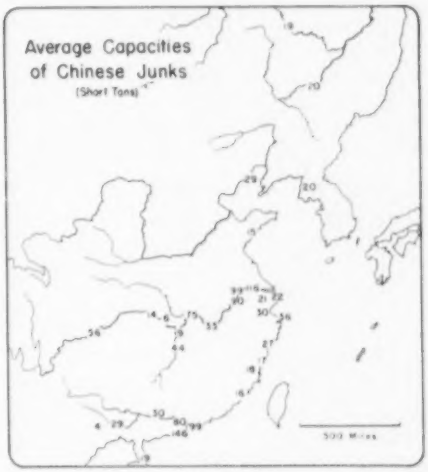

FIG. 2.

are exposed. The early period of rising water is most perilous because the rocks are hidden but only slightly submerged. The most favorable seasons, thus, are the intermediate periods (1) during March and April and (2) between September and October.

The duration of the journey by junk from I-ch'ang to Chungking is about one month, but the descent requires only from 8 to 20 days. The length of time is variably determined by the water stage, the importance of the shipment, and the competence of the crew. Smaller junks may make two or three round trips between I-ch'ang and Chungking during a year, but the large ones may only make one journey up and down. The loss and damage rate is heavy in this stretch of the river, affecting about 10 per cent of the junks and merchandise per year. A tremendous landslip resulting from extended heavy rains in 1896 created a new and hazardous rapid on the Upper Yangtze. In December of that year 100 junks and 1000 human lives were reported to have been lost at the newly formed

Hsin-luan T'an (rapid) since September 28 of the same year.

On the Min Chiang tributary of the Yangtze, junks with 44-ton capacity may reach as far up as Lo-shan (Chia-ting). Those with 110-ton capacity may reach as far as Ho-chou. On the Chia-ling Chiang, junks of 55-ton capacity reach as far as Sui-ning. On the I-ch'ang to Chungking section, steam and motor craft has largely replaced junk traffic, but on the upper tributaries the steam carriage depends upon junks to collect their downstream cargoes and to distribute their upstream freight.

I-ch'ang marks the beginning of the difficult gorge section and of the navigable Upper Yangtze. Before the junk traffic declined so markedly, there was a large floating population of trackers at I-ch'ang waiting to be hired for hauling junks through the gorges. It was, therefore, an important junk anchorage. A more important mart than I-ch'ang is Shasi. In 1920 its river front was densely crowded for two or three miles with junks anchored side by side. Behind the port a network of canals and lakes affords communications in many directions through the triangular plain that lies between the Yangtze and the Han River and reaches to Hankow.

Shasi is a commercial center on the middle Yangtze above Hankow in the region of the Li Ho and the Hou-kuang Canal. This region is one of the large cotton producing parts of China, so that cotton transport from the collection marts of the region has kept junk navigation here from any marked decrease. The most important junk routes here are as follows: (1) The route which runs from Shasi via Chiang-ling (Ching-chou) through Ch'ang Hu (Lake Ch'ang) and leads to Sha-yang and connects with the Han River, (2) another route also going via Ch'ang Hu but which then runs through the Ch'ang-hsia Ho to Tuan-k'ou or Hsin-t'an-k'ou to make connection with the Yangtze lower down.

Between the Yangtze and T'ung-t'ing Lake are two famous canals. One is the T'ai-p'ing Canal which starts at Hou-t'ou-k'ou, a short distance above Chiang-ling on the Yangtze, runs southward past Kung-an and An-chiang to enter the northwest sector of T'ung-t'ing Lake. The other is the Ngo-chen Canal which starts from Ngo-chen-k'ou about 40 miles downstream from Shasi, and runs via Nan-chen and San-Hsing-hang into the T'ung-t'ing.

While the Upper Yangtze junk traffic had almost disappeared by 1930 in the face of steam competition, junk activity in the Shasi sector had maintained about the same level of activity as that of a decade earlier. On the T'ung-t'ing and on the Hsiang River in Hunan, junk traffic actually had increased in spite of competition from the railroad, steamboats, and launches. The traffic by junk on the Yuan River in Hunan was slightly less prosperous than that on the Hsiang because it was limited to smaller vessels. In the section between Yuan-ling and Ch'ang-te, a distance of about 148 nautical miles, junks with capacities of 15–30 tons may use the river. Upstream from Yuan-ling, junks of only five to six tons capacity can traverse the river. The main centers of junk traffic in Hunan were Hsiang-t'an, Ch'ang-sha and Ch'ang-te.

North of T'ung-t'ing Lake, Hankow has at all times been the great center of junk traffic in central interior China, according to Wang. It has attracted junks from the entire drainage of the Han, Yangtze, Hsiang, and other rivers of Hunan and Hupei, as well as from the various lakes, including junks from the P'o-yang Lake area in Kiangsi Province. During the high water period

of summer and fall, junk traffic is most active. Most of the fluctuating population on the junks have been Hunanese, with lesser numbers of Hupei and Szechuan provincials. Contributing to the high level of junk traffic in this region is the fact that Hunan has provided much of the lumber for the construction of the junks used in this area, and the fact that Hunan is a great rice exporter.

Junks at Hankow, during the decade reported, generally anchored at particular anchorages according to the type of commodities they carried. There were more than 20 such anchorages arranged upstream along the Han River from its point of confluence with the Yangtze. During the time of the autumn harvests, junks virtually covered the surface of the Han passage here. Junks also tended to cluster according to provincial groups. Hunan, Hupei, and Kiangsi junks generally anchored along both banks of the Han, while Szechuan junks usually anchored along the Yangtze water front next to Han-yang City.

The large centers of junk traffic in the P'o-yang Lake network include Kan Hsien, Nan-ch'ang, Yao-chou, Wu-ch'eng, Chiu-chiang (Kiukiang), and Ho-k'ou. The junk traffic on the P'o-yang was said to be equal to that on the T'ung-t'ing, and Chiu-chiang compared with Hankow in junk activity. In addition to the main arteries of Kiangsi, their numerous small affluents as well as countless creeks and artificial canals make transport by junk to practically any point in the province a matter of comparative ease. Nor is this facility confined to the limits of the province. "So all-pervading are the ramifications of the waterways," asserted Wright,[8] "that an active junk-

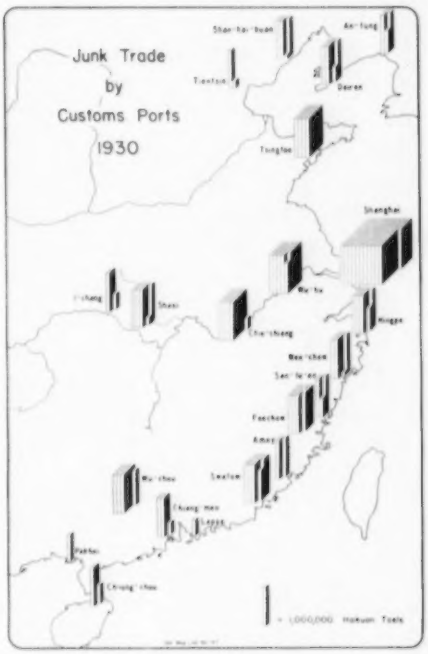

FIG. 3.

borne trade obtains on the eastern border between Kiangsi and the adjoining province of Anhui, while the land barriers that separate the water routes of Chekiang, Fukien, and Kwangtung from those of Kiangsi can be traversed even by a burdened coolie in a few hours."

Wu-hu on the Yangtze about 100 miles below Chiu-chiang and opposite the terminus of the railroad from northern Anhui Province, like Chiu-chiang, is an important rice port. Here, too, junk traffic was equally active in the decade, 1920–1930. It is interesting to note, wrote Wang, that after the Tientsin to P'u-k'ou Railroad reached the Yangtze opposite Nanking, junk traffic at Wu-hu showed a very marked rise. This seems to have been at least in part because rice, which had been shipped to northern China by sea, now began to move there

[8] Stanley Wright: "Kiangsi Native Trade and Its Taxation," Shanghai, 1920, pp. 2–3.

by rail. In this movement of rice from Wu-hu to Nanking, the cheap transport by junk involved less transshipment than movement by steamer over the short distance to the railroad. As a result, junk entries and clearances through Customs rose from only 27,718 in 1911 to 225,445 in 1925. In 1931 this figure had dropped down to 58,338. Most of the earlier figures do not distinguish empty junks, but the 1931 figure includes 31,011 empty junks.[9]

Chen-chiang, situated at the junction of the Grand Canal with the Yangtze, always has been a large center of the junk trade. Even in the early 1930's, junks loaded with wheat in spring and kidney beans in fall still descended in continuous file on the Grand Canal to leave their cargoes chiefly at the port of Chen-chiang. Below Chen-chiang, the Yangtze Delta junks do not carry much long-distance cargo. Most of them operate within only a short radius of Shanghai.

The navigable length of the Yangtze system is about 8850 nautical miles, of which about 4550 are accessible to junks alone, i.e., over 50 per cent of the total can be used only by junks not mechanically powered. Although the carrying capacity of the junks does not equal that of steamships and steam launches, the extent of their commercial network and the length of their routes are greater than those of the mechanized craft which also depend upon their transshipment services very heavily. River steamers operate on only 1690 nautical miles of routes, while steam launches may operate on another 2400 nautical miles.

In general conclusion, wrote Wang, one may say that:

(1) Junk traffic has been undergoing a gradual decline on the Yangtze, with the rate of decline most rapid on the Upper Yangtze.

(2) Where water transport is especially well-developed, and where the commodities transported are mainly of heavy bulk matter with a relatively stable price, junk traffic on the Yangtze is especially actively maintained. Hankow, Shasi, Chiu-chiang, and Wu-hu are striking examples of this situation.

(3) The passenger junks (so-called Mandarin junks) have largely disappeared on the Yangtze, except for short-trip use.

(4) Merchandise or freight junks largely limit their carriage to short distance routes, mostly between the producing areas and the nearest ports of importance.

(5) Junk traffic on the river system as a whole has withdrawn upstream and toward the tributaries of the Yangtze River.

THE SIZES AND CAPACITIES OF TRADING JUNKS

The studies of Chinese junks by Donnelly, Worcester, Wright, and others have detailed the multitudinous types of junks operating in China together with the range in capacities among the different types. These studies have not provided indications of average capacities of the junks most prevalent in trade, however, and such averages also change with the changes that have affected the volume and location of junk traffic. The large tonnage junks described in the accounts have mostly disappeared, since they traded along the routes open to larger steam traffic. The major proportion of the junks that remain, therefore, are those with shallow draft that can operate on streams not open to steam traffic. Table III has been computed from statistics in the Annual Trade Returns of the China Maritime Customs for 1931. The total

[9] China Maritime Customs, "Decennial Reports," Vol. 1, *op. cit.*, p. 601.

tonnages entered and cleared in each port was divided by the number of entries and clearances during the nine-year period 1922–1930 inclusive, and the result was divided by nine to obtain the average figure for junks cleared during one year. For the ports where only Maritime Customs figures were available, the figure is followed by (M.C.). The rest indicate National (Native) Customs (N.C.) figures.

From the table one can notice interesting variations in the sizes of junks trading at the different ports of China. To find the most prevalent size of junks operating throughout China, it is best to use figures from the National Customs only, since the overwhelming majority of junks passing through Customs offices were recorded by the National rather than by the Maritime Customs. The average size of junks thus calculated was 26.3 short tons in contrast to 58.8 tons for junks passing through the Maritime Customs. It is obvious, therefore, that most of the trading junks in China are small craft, and that the very large junks (over 100 tons) are rarely encountered.

TABLE III

AVERAGE JUNK CAPACITIES

Port	*Capacity in Short Tons*
Shanghai	21.5 (M.C.)
Soochow	21.2 (M.C.)
Chen-chiang	116 (M.C.)
Nanking	98.5 (M.C.)
Wu-hu	90 (M.C.)
Chiu-chiang	33.2 (N.C.)
Hankow	75 (M.C.)
Ch'ang-sha	44.4 (M.C.)
Yo-chou	19.4 (M.C.)
Shasi	5.7 (N.C.)
I-ch'ang	14.1 (N.C.)
Chungking	55.5 (M.C.)
Aigun	18.6 (M.C.)
Harbin	20.1 (M.C.)
An-tung	19.8 (M.C.)
Shan-hai-kuan	28.8 (N.C.)
Tsingtao	14.6 (N.C.)
Hangchow	30.2 (M.C.)
Ningpo	35.8 (N.C.)
Wenchow	27.2 (N.C.)
San-tu-ao	16.6 (N.C.)
Foochow	18.2 (N.C.)
Amoy	15.9 (N.C.)
Kowloon	99 (M.C.)
Wu-chou	29.8 (N.C.)
Nan-ning	29 (N.C.)
Lung-chou	4.0 (M.C.)
Lappa	82.5 (M.C.)
Macao	146.0 (M.C.)
Chiang-men	79.7 (N.C.)
Ch'iung-chou	19.1 (N.C.)

THE ECONOMIC VALUE AND RELATIVE SIGNIFICANCE OF THE JUNK TRADE

In Table IV the value of trade and the relative significance of junk trade in the entire trade of the port in 1930 are shown for the Treaty Ports where both Maritime and Native Customs existed prior to 1931. The statistics for values in (000's of) Haikuan Taels (one HK Tael in 1930 equaled U.S. $0.46) are derived from the China Maritime Customs Annual Trade Returns for 1931 and include so-called "native exports," but not the "re-exports" of the port. (This differs from the "net value" of the trade.) The percentages were calculated. The number of junks entered and cleared are the total entries for both Maritime and National Customs, also from the Annual Trade Returns.

The table of percentages of trade carried by junk at once shows the significance of the junk traffic in the different ports of China, both as to domestic trade and as to the total foreign and domestic trade of the ports concerned. In some instances, as at Lappa, Chiang-men, and Wu-chou, over 50 per cent of the domestic trade in terms of value is carried by junks. By contrast, the junk trade at Tientsin appears to be negligible. For the ports as a whole (the omissions such as Hankow, Canton, and others probably would not affect this materially) the junks count for only about 9 per cent of the entire value of trade, but for over 17 per cent of the value of domestic trade in 1930. Another interesting point brought out by the table is that the number of junk entries and clearances, i.e., the degree

TABLE IV

VALUE AND SIGNIFICANCE OF JUNK TRADE IN 1930

Port	Value of N.C. (Junk) Trade	Value of M.C. Trade		Per Cent of N.C. to M.C. and N.C.	Per Cent of N.C. to N.C. and Domestic Trade of M.C.	Number of Junks Entered and Cleared
		Entire Trade	Domestic Trade			
Shanghai	114,017	1,549,482	706,841	6.8	13.9	58,109
Ningpo	10,594	53,456	38,458	16.5	21.6	7,741
Wenchow	7,084	15,148	13,155	31.8	35.0	7,044
San-tu-ao	3,544	2,975	2,822	54.5	55.6	11,722
Foochow	14,981	44,736	29,918	25.1	33.4	29,327
Amoy	3,004	45,537	20,263	6.2	12.93	47,080
Swatow	14,774	108,879	55,126	12.3	21.2	110,318
Lappa	395	16,842	392	2.3	50.0	10,026
Chiang-men	4,334	12,027	927	26.8	81.2	3,398
Wu-chou	12,932	22,962	10,939	36.0	54.3	6,903
Ch'iung-chou	2,526	8,407	3,580	23.2	41.8	5,368
Pakhoi	709	6,895	2,634	9.3	21.5	4,492
An-tung	3,574	92,717	18,259	3.7	16.4	21,176
Dairen	7,432	403,804	86,241	1.8	7.9	18,784
Shan-hai-kuan	5,069	98,480	71,573	4.9	6.6	8,167
Tientsin	1,178	318,236	135,771	0.4	0.9	493
Tsingtao	20,038	186,457	97,371	9.7	17.2	11,725
I-ch'ang	2,444	18,252	17,909	11.8	12.0	8,323
Shasi	10,231	21,635	21,472	31.8	32.2	17,140
Chiu-chiang	20,259	55,586	52,651	26.4	27.8	17,459
Wu-hu	24,783	50,011	46,115	33.1	35.0	154,447
Totals (only for ports here listed)	283,902	2,830,074	1,327,594	9.1	17.6	561,242

NOTE: Hankow which had a total M.C. trade value of HK Taels 258,480,574 and a domestic trade recorded by M.C. of Taels 219,213,254 had no figures for National Customs trade or junks going through N.C. Only 253 junks were recorded in 1930 going through M.C.

of local junk movement, may not be significant in terms of the trade value of their cargoes. Thus, 154,447 entries and clearances at Wu-hu in 1930 accounted for only 24.7 million taels worth of cargo, whereas at Shanghai only 58,109 entries and clearances accounted for 114 million taels worth of cargo. However, a note explains that in the Wu-hu figure were included 78,004 empty junks. It appears probable that other figures for entries and clearances also include a proportion of empty junks, although no indication may be given of this.

The average value of a junk cargo cannot be reliably estimated for most ports or for all the ports as a whole because of the above uncertainty. Taking only the junks carrying cargo at Wu-hu in 1930, the average cargo value here was 324 taels or the equivalent of U.S. $149. If we assume that all the junks entering and cleared carried cargo, the Wu-hu junk cargo would be valued at only about half this much, or about U.S. $75. On the same basis, the value of the average junk cargo operating out of Shanghai rises to the figure of U.S. $890. For the national average, the value would be U.S. $194. It is clear that average cargo values vary widely from port to port, and that the average value for most ports is low. Accounting for a small-percentage error in this calculation is the fact that the total number of junks in the table includes the small numbers recorded by the Maritime Customs that have been added to the entries and clearances in the National Customs, while the value of the junk trade as listed does not take account of the value of cargo carried by

TABLE V

ANALYSIS OF JUNK TRAFFIC FOR THE PORT OF AMOY

	Average Annual Customs Entries and Clearances	*Round-trip Distances Involved*	*Number of Trips Per Junk Per Year at Optimum*	*Number of Junks Active on the Route*
Foochow	1	210	1	1
Swatow	248	141	81	3
Formosa	302	210	50	6
Wenchow	159	174	29	5
Intra-district	54,250	54	194	283
Total number of junks active				298

the junks going through Maritime Customs.

THE ESTIMATION OF JUNK NUMBERS AND THEIR "ACTIVITY FACTORS"[10]

While no reliable statistics exist for the number of trading junks (as apart from fishing junks), some approximation of the probable number may be computed from Customs entries and clearances. The computation for Amoy may serve as an example. The Customs figures show the entries and clearances to and from Amoy by localities of origin and destination during various years. The average total for a year is obtained for the period 1922–1930 inclusive. Distances between Amoy and ports of origin and destination are calculated in nautical miles. Sailing speeds are estimated or obtained. Thus, it takes about seven days and nights for a junk to sail between Shanghai and Dairen on the average, with favorable winds. The distance from Shanghai to Dairen is about 298 nautical miles. The junk speed on such a trip, therefore, is 42.6 nautical miles in 24 hours, or about 1.78 nautical miles per hour. Where the trips are confined to rivers or to coastal routes dangerous for night travel, the day's trip may be assumed to be only 21 nautical miles. It is further assumed that because of requirements for loading and unloading, repairs, and other delays, a junk spends only two-thirds of the year's time under sail, or about 250 days. (This figure may be too high, a more conservative figure is only one-third of the year's time.)

The average number of trips between Amoy and Formosa by trading junks is 302 (entries and clearances). The round-trip distance is 210 miles, requiring 210 divided by 42.6, or five days and nights, for a junk to sail. On the average, then, a junk engaged in full-time trade between Amoy and Formosa the year-round could make 250 divided by 5, or 50 trips at the optimum (i.e., 50 entries and clearances at the Customs station). Since 302 entries and

[10] In evaluating the Chinese junk trade one is confronted with the unreliability of reported figures. The statistical dilemma is instituted in the first place by the varying definition of a "junk" as distinguished from a sampan. At Tsingtao the average capacity of native craft small enough to be designated "sampan" by the Maritime Customs was 7.6 tons in 1930, and they were, therefore, excluded from the Customs listing. On the other hand, the average capacity for all craft recorded as entering and clearing Customs at Lung-chou in the upper reaches of the Hsi River in South China was only about four tons.

A second aspect of the statistical dilemma is that the Customs figures do not list actual number of junks operating at a port, but merely record the number of entries and exits made during a year. In the total figure, an entry counts as one and a clearance or exit counts as another, so that 4000 entries and clearances mean actually 2000 round trips into and out of the port. Junks engaged in short-distance trade may make many such round trips, so that a total of only 200 junks could account for the 4000 entries and clearances listed. Some writers have confused the Customs entries and clearances with the actual number of active junks in the port.

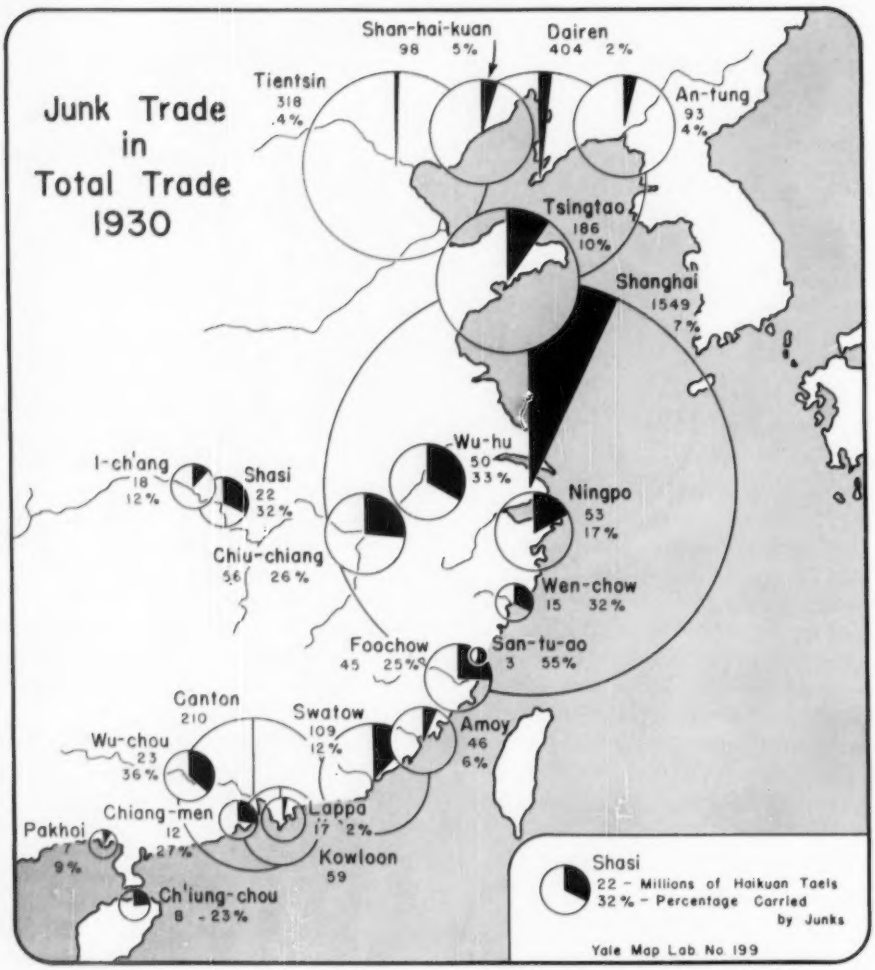

FIG. 4.

clearances were made on the average annually between 1922–1930, a total of 302 divided by 50, or roughly six junks would be sufficient to effect 302 entries and clearances on this route. The estimated probable number of junks on this route at Amoy, therefore, is taken as six.

When this probable number is found for each of the routes operating from Amoy, the total for them is added up to make the probable number of junks in active trade at the port. Table V gives the figures listed and computed for Amoy by ports or regions with which it trades. Since the total numbers of entries and clearances for Amoy is 54,950, the average activity factor is obtained by dividing this number by the number of junks in active trade, or 298. The activity factor for Amoy, therefore, is 185.

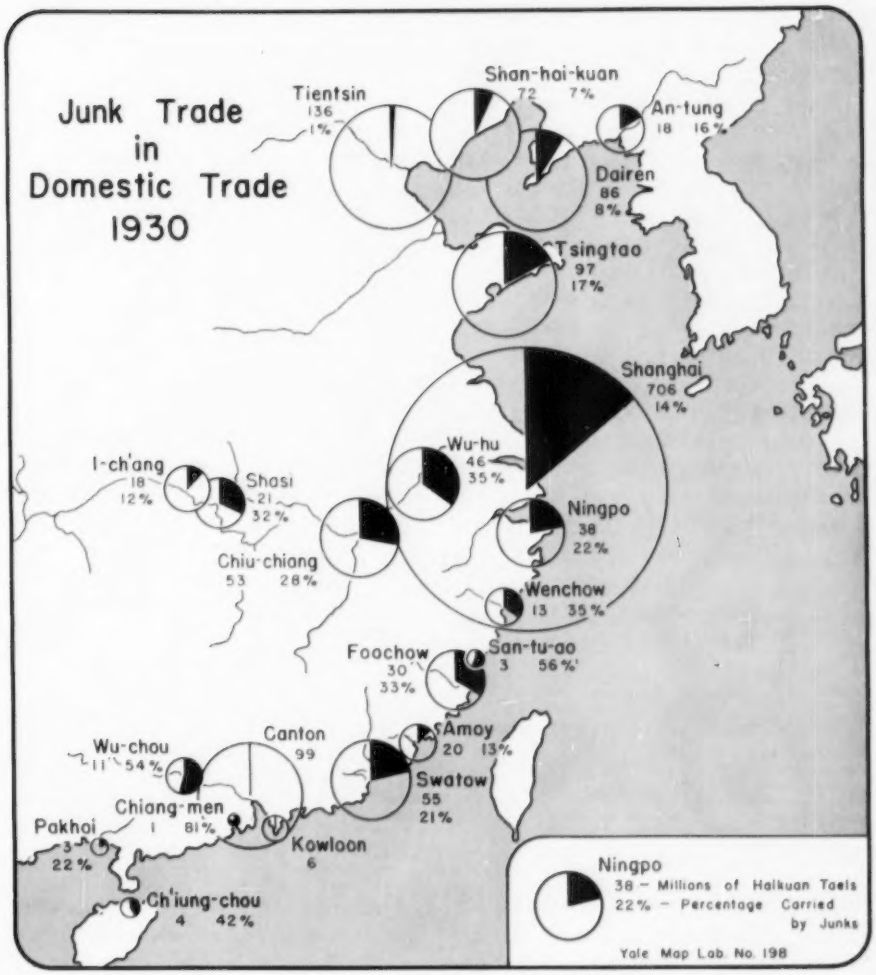

FIG. 5.

If data were available and this type of calculation were carried out for each port, the totals obtained for all the ports would represent a rough estimate of all the junks active in trade in China. A close approximation to this may be obtained by using average activity factors for a representative selection of ports and dividing the average activity factor for all the selected ports into the total number of recorded junk entries and clearances. Table VI gives the activity factors and the number of active trading junks in a selected number of representative ports for China.

The average activity factor for coastal areas is calculated at 63; for the Yangtze ports it is only 33.

In Table VII the average number of junk entries and clearances regionally were obtained from the figures for the different ports for the nine-year period,

1922–1930.[11] These have been divided by the average activity factors for river and coastal ports as the case may be, yielding the number of active trading junks regionally. It would appear that, provided no grossly wrong assumptions were made in the calculation method, only some 14,384 junks were in active trade and transport outside of the fisheries in China during the 1930's. These accounted for 655,893 entries and clearances in the Customs. This data would indicate that each junk on the average made 46 round-trips on its trade route during the course of a year, 46 being the average activity factor for the entire country. On the face of it, this appears somewhat excessive. It means that, if sailing time amounted to 250 days annually, the average round trip on a junk route is about 5.5 days.

TABLE VI

ACTIVITY FACTORS AND ACTIVELY TRADING JUNKS

Port	*Activity Factors*	*Number of Junks Active*
Shan-hai-kuan	51	153
Tientsin	48	19
Tsingtao	89	92
Shanghai	36	1,468
Wu-hu	38	4,002
Shasi	25	1,201
Ningpo	35	249
Wenchow	66	101
San-tu-ao	88	129
Foochow	66	514
Swatow	59	1,671

This figure can be checked by calculating the average distances traveled by the majority of junks, using the data offered by the *Annual Trade Returns*. Table VIII gives such calculations by the percentage of junks traveling various distances. From this table it is evident that three-quarters of the coastal junks operate within a 100-mile radius, whereas river junks travel longer routes on the average. On the coastal routes where night travel is feasible, 5.5 days would mean a distance of 230 nautical miles traveled for the round trip, or 115 for one-way. On the river routes, 5.5 days would account for only a round-trip distance of 115 miles, or a one-way distance of 58 miles.

TABLE VII

REGIONAL ANALYSIS OF JUNK TRADE

Regions	*Average Annual Entries and Clearances*	*Junks Active in Trade*	*Per Cent of Junks in Region*
South Manchuria	24,521	390	2.7
North China	21,834	346	2.4
Shanghai	57,055	1,468	10.4
Yangtze ports	215,151	6,500	45.0
Southeast coast	177,011	2,800	19.5
South China coast	137,445	2,180	15.1
Hai Chiang ports	22,876	700	4.9
Totals	655,893	14,384	100.0

From the preceding, it would seem that the activity factor should be adjusted to a lower figure, perhaps to one-half, in order to be on the conservative side. If this were done, the estimated probable number of junks active in trade for all of China would be twice as much, or 28,768. Finally, to be doubly conservative, the supposition that junks are under sail 250 days of the year may be halved to make this 125 days per year. This would involve another doubling of the estimated probable number of junks to 57,536 for all of China. It does not seem reasonable to this writer that there are more than

[11] China Maritime Customs: "Annual Trade Returns, 1931," Shanghai, 1932.

this optimum number of junks in active trade in China. The probability is that the number in the 1930's was somewhere between 20 and 50 thousand, not counting sampans of, say, under two-three tons capacity. Using the average estimated capacity of 26 tons per junk, the carrying capacity of the junks in China commerce in the 1930's was between 520,000 and 1,300,000 tons.

THE PRESENT-DAY SIGNIFICANCE OF THE JUNK TRAFFIC

When we compare the probable present-day situation with the situation of the 1930's, several factors of decrease must be taken into account. First, the overall trend in junk numbers and junk traffic has been steadily downward ever since the introduction of steam and motor shipping. The long period of warfare with Japan from 1937 to 1945 not only resulted in the destruction of numerous junks, but also brought a long period of disorganization and immobilization in the internal trade, when junks rotted at their anchorages and otherwise deteriorated. The initial postwar impact of the introduction of a very large tonnage of lend-lease steam vessels must have proved discouraging to any building up of the junk tonnage.

Compensating factors increasing the significance of the junk in present-day

TABLE VIII

TRAVEL DISTANCES OF COASTAL AND RIVER JUNKS

Distance in Nautical Miles	*Percentage of Junks on Such Routes*
COASTAL ROUTES	
Under 40	45.5
Under 100	72
Under 200	96
Over 200	4
RIVER ROUTES	
Under 40	2.7
Under 100	57
Under 200	82.5
Under 300	89
Over 300	11

TABLE IX

TONNAGE OF VESSELS REQUIRED IN 1932

	Tonnage Entered and Cleared	*Percentage of Total*
FOREIGN TRADE		
Chinese owned	4,337,494	9.74
Alien owned	40,203,311	90.26
DOMESTIC TRADE		
Chinese owned	29,550,674	32.52
Alien owned	61,317,917	67.48

Communist China, however, include the fact that foreign shipping, once permitted to ply China's coastal and inland routes engaging in Chinese domestic trade, now no longer is permitted to do so legally. (Actually, some coastwise foreign shipping appears to be going on.) Chinese Communist shipping, therefore, is not enough to meet domestic needs. The tonnage of vessels formerly required in the China trade is shown by the situation in 1932 (Table IX).[12]

Table IX shows that China depended upon alien shipping not only for her foreign trade needs but also for her domestic requirements. Over 67 per cent of her domestic trade depended upon alien shipping. For the same amount of domestic trade, Chinese shipping now must supply the 67 per cent deficit in shipping, most of which, of course, was steam shipping. In 1929 there were reportedly 528 Chinese owned ships of western type, with a tonnage of 423,000 tons. In 1950, according to the Ya-kuang atlas, mainland Communist China had only 319 ships totaling 275,000 tons.[13] Up to May, 1953, at least another 100,000 tons were added by purchase from abroad.[14]

Thus, at present, Communist China

[12] China Maritime Customs: "The Trade of China, 1932," Shanghai, 1932, p. 92.

[13] Ya-kuang Geographical Society: "Provincial Atlas of the Chinese Peoples Republic," Shanghai, 1952. See text back of Plate 19.

[14] China News Service, May 19, 1953.

apparently still has not the amount of shipping tonnage that China had in 1932 to take care of the 32 per cent of her domestic shipping carried by Chinese bottoms. The need occasioned by the withdrawal of foreign shipping accounting for the other 68 per cent then carried is not being met at all. It would be logical to assume, therefore, that there is greater dependence upon the Chinese junk to carry the domestic trade of the country than there has been for half a century. There is little doubt that the Communist regime is making strenuous efforts to build up junk shipping as well as to purchase foreign shipping, for the former requires no foreign exchange. One may safely conclude that, proportionally, junk traffic in China's domestic trade has been enhanced greatly in economic as well as strategic significance.

TABLE X

CHINA INLAND WATER ROUTES OPEN TO JUNK TRAFFIC*

Rivers	*Nautical Miles of Route*	*Upper Terminus*	*Lower Port*
Yangtze	1,370	I-pin	Shanghai
Hei-lung (Amur)	1,282	Mo River	Ussuri River
Han	665	Han-chung (Nan-cheng)	Hankow
Hsi	535	Nan-ning	Canton
Chia-ling	320	Pai-shui-chiang	Chungking
Chu (Pearl) delta n. t	420	.....	.....
Yuan	382	Huang Hsien	Han-shou
Lower Sungari	375	Harbin	Amur River
Ussuri	330	Hsin-k'ai River	Amur River
Kan	340	Kan Hsien	Hu-k'ou
Hsiang	278	Ling-ling	Ying-t'ien
Liu Chiang	268	Ch'ang-an	Kuei-p'ing
Tz'u-Shui	260	Yuan-chiang	Wu-kang
Yu Chiang	253	Pai-ssu	Nan-ning
Kuei	249	Hsing-an	Ts'ang-wu
Pei Chiang	210	Ch'u-chiang	San-shui
Fu Ho	208	Kuang-ch'ang	Nan-ch'ang
Hsing Chiang	202	Yü-shan	Nan-ch'ang
Tso Chiang	180	Lung-chou	Nan-ning
Min Chiang	177	Ch'eng-tu	I-pin
Ch'ien-t'ang	177	K'ai-hua	Hangchow
Min	174	Nan-p'ing	Ch'ang-men
Chin Chiang	165	Wan-tai	Nan-ch'ang
Yuan Shui	154	I-ch'un	Nan-ch'ang
Hsiu Shui	150	Hsiu Shui	Nan-ch'ang
Lower Sungari	130	Nun Chiang	Harbin
Tung	124	Lao-lung	Canton
Yung-shao Canal	73	Yü-yao	Hsi-hsing
Yü-yao River	67	T'ung-ming	Yin Hsien
Han Chiang	64	Ta-p'u	Ch'ao-an
Feng Shui	60	Tz'u-li	Ching-shih
Chin Chiang	55	Nan-an	Hsing-p'u
Liao	29	T'ai-tzu River	Ying-k'ou
Nun Chiang	25	Ta-lai	Sung-hua River
Sung-hua south branch	24	Nun Chiang	Fu-yü

*Jen-min Shou-ts'e (People's Handbook) 1952, Shanghai, 1952, pp. 419–20.

THE PATTERN OF POPULATION TRENDS IN MASSACHUSETTS

Jean Laing

Miss Laing, formerly an Assistant at the University of Glasgow, became interested in population trends in Massachusetts while she was a graduate student at Clark University.

THIS study is an attempt to evaluate regional differences within the state of Massachusetts by means of analyzing population trends. State boundaries are somewhat arbitrary limits, but Massachusetts has the advantage of being characterized by a wide range of physical and economic conditions. Furthermore, the orientation of the state is such that it cuts across the north-south trending divisions of New England, and so presents greater diversity of conditions than does any other New England state. In addition, statistical information for Massachusetts, as for all of New England, is available by minor civil divisions (cities and towns)[1] which are of fairly uniform area.

The Method

Population trends for Massachusetts cities and towns from 1870 to 1950 were plotted on semi-logarithmic graph paper, and the resultant curves were grouped into categories on the basis of similarity of shape. The categories were plotted on minor civil division maps of the state, so that their regional patterns might be discerned and spatial relationships assessed.

The starting point of 1870 was chosen because minor civil division boundaries in Massachusetts have been relatively stable since that date. Previous to that time, re-allocations of territory and division of towns were frequent. Changes in boundaries since 1870 have been noted, and allowance made. Another advantage of starting at 1870 was that that year marks approximately the close of the period of instability produced by westward migration and the early phases of industrialization. The change to rail transportation was essentially completed by that time, and the resort industry was beginning to develop.

Of the several possible classifications of population curves for the 350 cities and towns of Massachusetts, two dealing with the entire period, and one covering only the last 30 years, are presented here.

1870–1950. Four Categories

Figure 2 shows the broadest classification, a grouping into four categories: (1) sharp to intermediate rise; (2) slight rise, or decline followed by a rise; (3) steady; (4) decline. Figure 3 shows a sample curve for each of the categories. A residue of some ten or twelve scattered towns remained, towns which did not

[1] The whole of Massachusetts is divided into minor civil divisions for the purposes of administration. The terms "town" and "city," as used in New England, require some explanation. In the first place, "town" and "city" refer to political organization, not to size. Although, in general, cities have a greater population than towns, this is not necessarily the case. In the second place, the term "town" refers to a complete political unit which may contain several urban clusters, and "city" is likewise an administrative rather than a descriptive term.

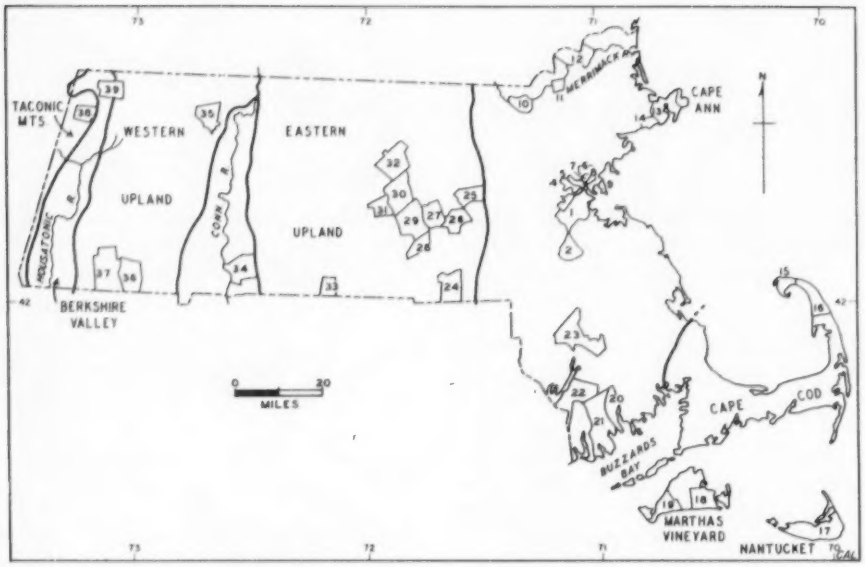

FIG. 1. Location map of Massachusetts. Numbers refer as follows: 1, Boston; 2, Canton; 3, Brookline; 4, Cambridge; 5, Somerville; 6, Malden; 7, Everett; 8, Chelsea; 9, Winthrop; 10, Lowell; 11, Lawrence; 12, Haverhill; 13, Gloucester; 14, Manchester; 15, Provincetown; 16, Truro; 17, Nantucket; 18, Edgartown; 19, Chilmark; 20, New Bedford; 21, Dartmouth; 22, Fall River; 23, Taunton; 24, Uxbridge; 25, Marlborough; 26, Westborough; 27, Shrewsbury; 28, Millbury; 29, Worcester; 30, Holden; 31, Paxton; 32, Princeton; 33, Holland; 34, Springfield; 35, Shelburne; 36, Tolland; 37, Sandisfield; 38, New Ashford; 39, North Adams.

fit well into any of the four. These have extremely irregular curves as a result of circumstances peculiar to the individual towns.

The map reflects the major areas of the state in broad outline. Eastern Massachusetts as a whole has been gaining population in comparison with western Massachusetts. The main urban areas stand out as places of population increase, and increases also emphasize resort development along the coast and on eastern Martha's Vineyard. There are small areas of static or declining population to be found on Cape Cod, and in the lower Merrimack Valley; Nantucket and the western towns of Martha's Vineyard show similar trends. In western Massachusetts, the lower Connecticut Valley and most of the Housatonic Valley stand out as areas of rise in contrast to the general aspect of decline.

1870–1950. EIGHT CATEGORIES

The second map shows the results of division into a greater number of categories (Fig. 4). In this case eight are plotted: (1) sharp rise; (2) intermediate rise; (3) slight rise; (4) decline followed by a rise, aggregate gain; (5) steady; (6) decline followed by a rise, aggregate steady; (7) decline followed by a slight rise, aggregate loss; (8) decline. Examples of each of the eight types may be seen in Figure 5. As before, there is a small number of scattered towns that defy classification by virtue of their very irregular curves.

The map showing eight categories (Fig. 4) presents a far more detailed picture than the previous one, Figure 2.

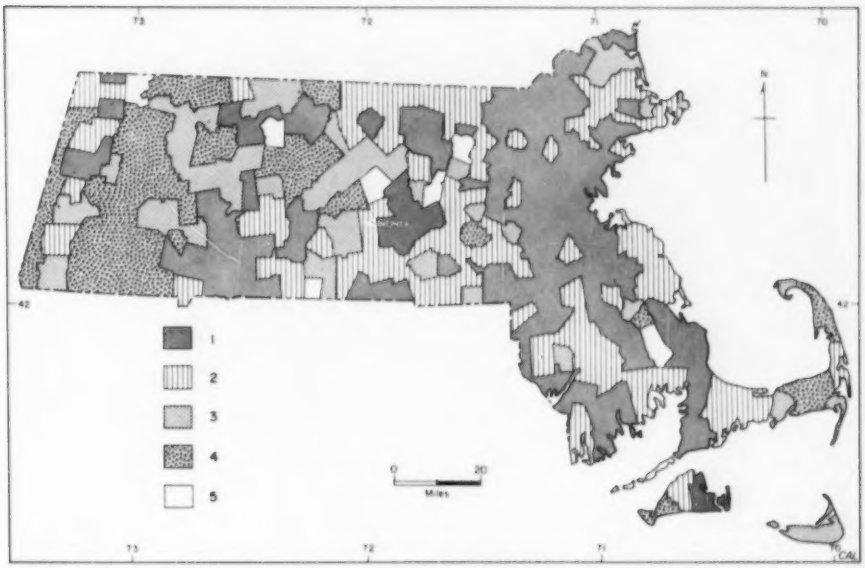

FIG. 2. Massachusetts cities and towns classified according to semi-logarithmic graphs of population, 1870–1950. Numbers refer as follows: 1, sharp to intermediate rise; 2, slight rise, or decline followed by a rise; 3, steady; 4, decline; 5, unclassified.

For instance, the category of sharp rise, which represents a gain of over 300 per cent, characterizes the suburban areas around the urban foci of the State. Within this group may be distinguished a ring of towns around Boston, Cambridge, and Chelsea, which themselves form an enclave of less rapid growth. This ring represents the outward moving wave of suburban development. There are two towns in this category bordering Worcester, but a distinction should be made between the curves for the two groups. The curves for the towns near Worcester are concave in form, showing an accelerating rate of increase; whereas those around Boston have a convex form, showing maturity and a diminishing rate of increase (see Brookline, Fig. 5). Another significant locality of sharp rise is the Springfield area, which in this case includes the central city itself. This inclusion is due to the extensive area incorporated within city limits which enabled development to be continued at a sharper rate, and over a longer period, than is usual with central cities.

The category of intermediate rise includes a diverse group: older urban

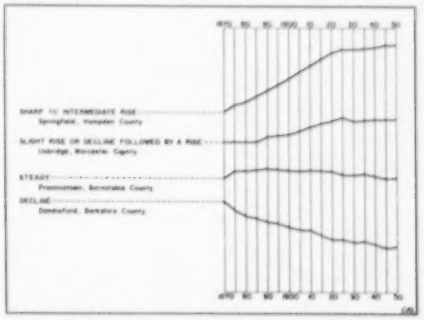

FIG. 3. Representative semi-logarithmic graphs for the four categories, 1870–1950. Note that in these graphs, and in those in Figures 5 and 7, the absolute values are not shown, although they were used in plotting the curves. This omission facilitates the classification of graphs on a form basis, which was the method used in this study.

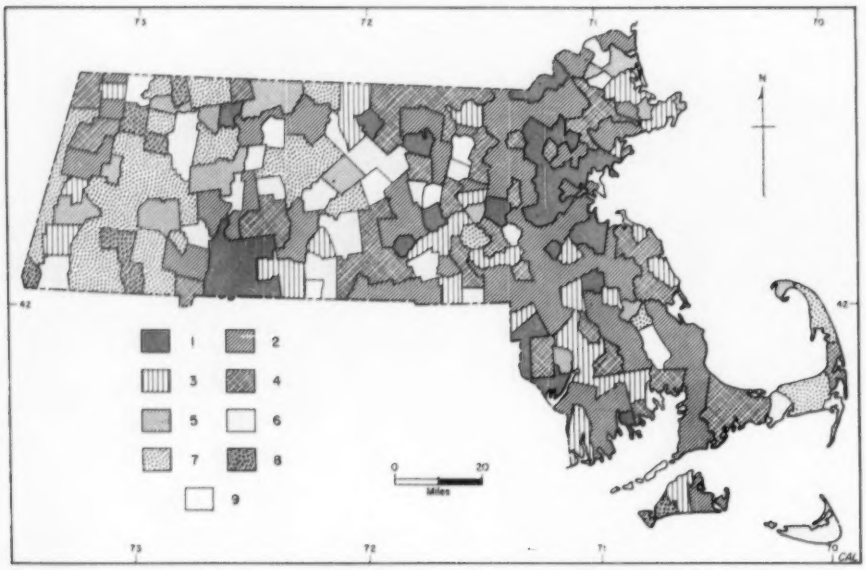

FIG. 4. Massachusetts cities and towns classified according to semi-logarithmic graphs of population, 1870–1950. Numbers refer as follows: 1, sharp rise; 2, intermediate rise; 3, slight rise; 4, decline followed by rise, aggregate gain; 5, steady; 6, decline followed by a rise, aggregate steady; 7, decline followed by a slight rise, aggregate loss; 8, decline; 9, unclassified.

centers like Boston, Worcester, and Fall River; newer suburban towns contiguous to a city, e.g., Holden near Worcester; the more remote commuting towns; and resort towns like Dartmouth bordering Buzzards Bay and Edgartown on Martha's Vineyard (Fig. 1). In all these cases the automobile has been the dominating force in encouraging dispersion from the city center, and in increasing the demand for recreational facilities.

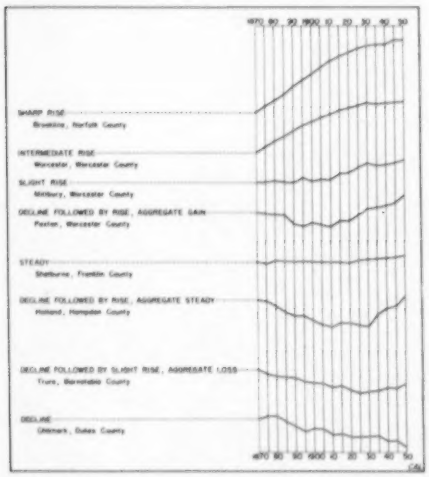

FIG. 5. Representative semi-logarithmic graphs for the eight categories, 1870–1950.

The category of slight rise includes three types of towns. First there is the old established market town or route center which has maintained a steady rate of expansion, largely through early industrialization, despite being too far from a major nucleus to have received a notable stimulus for growth. Taunton, Marlborough, and North Adams are examples of this type. Second are the more remote semi-rural towns such as Westborough and Canton, where suburban development is beginning. Third are the coastal towns, in some cases old ports, where an increase of population has continued due to the

advent of resort trade to offset a declining fishing industry, as in Gloucester.

Towns that have shown a decline followed by a rise to an aggregate gain are largely rural. These shared a decline in agricultural activity until the early 20th century, when improved transport brought them within range of daily travel to the cities. In such cases local farming could then be combined with commuting. Many of the Eastern Upland towns fall into this group. Also in this category are several coastal towns where farming or fishing declined, but where a revival may be due either to resort and tourist trade, or to the possibility of commuting to an urban center, or to some combination of the two. A group of towns near the coast south of Boston are of this type.

Some towns of Massachusetts showed no appreciable gain or loss over the 80-year period. In some cases they are rural towns with small populations. Many are valley towns in western Massachusetts, either in the Housatonic or Connecticut valleys. In these cases they often represent towns with both upland and lowland terrain, where a loss of population from the upland is balanced by a gain in the valley. A third group of these towns where the population has remained steady lies to the north of Cape Ann.

In the towns which suffered an early decline followed by a rise insufficient to aggregate a gain, either the revival has come too recently to reach significant proportions and is possibly incomplete, or the revival has not been sustained to date. These are likely to be the more remote resort and residential towns whose revival was delayed until the 'thirties, or where an earlier decline had been more abrupt so that a greater upswing was needed to offset it.

In the category of decline followed by a slight rise to an aggregate loss, the hill towns predominate, though there is an additional group of five on Cape Cod. The Western Upland and Taconics are conspicuous on the map, with the Berkshire Valley represented by a belt of steady to varying degrees of rise lying between them. There are also several towns in this category in the Eastern Upland, usually in the hillier and more remote areas.

Only a few Massachusetts towns have shown a consistent decline in population over the whole 80-year period. Six hill towns in western Massachusetts belong to this group and two towns on Martha's Vineyard. The island towns are those more removed from the ports and ferry service. Apparently, the tourist trade has not yet caused these towns to revive from their long period of agricultural decline.

From this division of towns into eight categories certain trends become evident. Over the 80-year period, people have tended to move away from the upland towns towards the lowlands, from the strictly farming towns to the cities, particularly to the suburbs of the larger cities. The tide of increase is creeping slowly over Cape Cod. It is perceptible on Martha's Vineyard but not on Nantucket.

1920–1950

In the process of classifying the curves it became obvious that the last 30 years have been particularly significant in affecting trends. During that time, startling changes and even reversals of earlier trends have taken place. It was decided, therefore, that these years might be worthy of closer scrutiny. Consequently, a classification of graphs for this 30-year period was made, taking into account the degree of change wherever a constant trend was maintained.

Under this classification six categories were distinguished, plus a residue

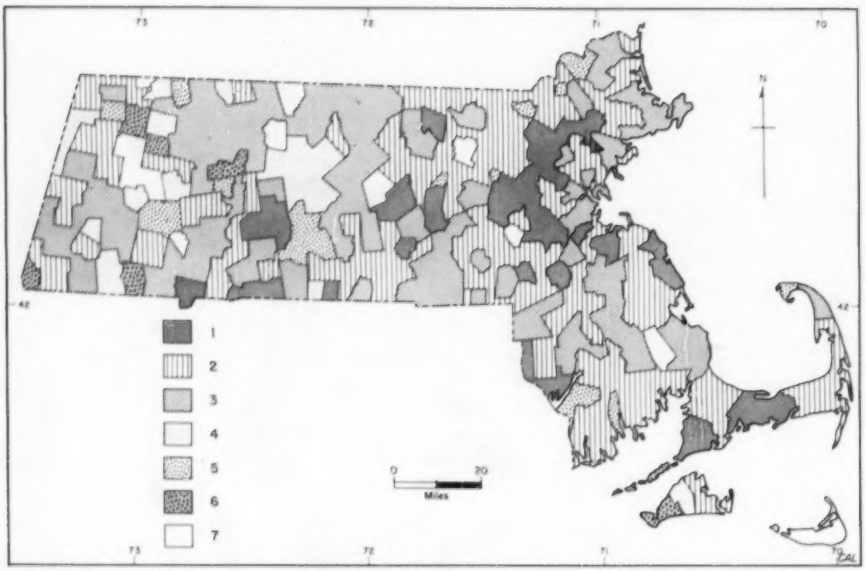

FIG. 6. Massachusetts cities and towns classified according to semi-logarithmic graphs of population, 1920–1950. Numbers refer as follows: 1, sharp to intermediate rise; 2, slight rise; 3, steady (either no appreciable rise or a gain of less than 25 per cent); 4, slight decline and partial recovery; 5, slight decline, less than 25 per cent; 6, decline of more than 25 per cent; 7, unclassified.

of unclassifiable towns. Typical curves are shown in Figure 7. These represent (1) sharp to intermediate rise; (2) slight rise; (3) steady (either no appreciable rise or a gain of less than 25 per cent); (4) slight decline and partial recovery; (5) slight decline, less than 25 per cent; and (6) decline of more than 25 per cent.

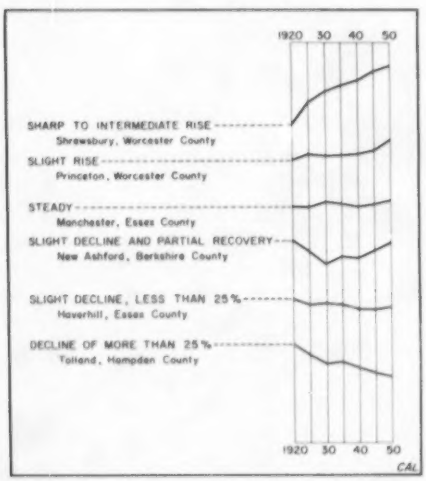

FIG. 7. Representative semi-logarithmic graphs for the six categories, 1920–1950.

The resulting map (Fig. 6) has certain unique merits. In the first place, the situation with regard to Boston is more clearly revealed than on the other maps. A threefold division becomes apparent. In the center lies a group of towns and cities including Boston, Cambridge, Somerville, Malden, Everett, and Winthrop, which have maintained a constant population, or made gains of less than 25 per cent during the last thirty years. One city, Chelsea, shows a loss. On Figure 4 these places showed an intermediate rise over the last 80 years and, in some cases, even a sharp rise. Obviously, then, their population curves are flattening, and their period of significant population increase largely preceded World War I. Beyond these

cities and towns lies a group showing a slight rise (more than 25 per cent gain). They are the older suburbs and satellite industrial towns of the Boston Basin. Here, too, the peak period has passed, for many of these same towns fall into the highest category in Figure 4. Beyond them again lies a ring, nearly continuous, of towns showing a sharp to intermediate rise since 1920. These are the newer suburbs where commuting has become possible due to improved means of transport, particularly the automobile.

A similar situation can be found at Worcester and Springfield, though the concentric rings are discontinuous in these cases. This map shows the presence in eastern Massachusetts of several waning industrial towns. These did not show up on Figure 4, for the decline has been too recent and of insufficient amount to offset the previous period of gain. Three towns of the Merrimack Valley—Lowell, Lawrence, and Haverhill—show declines, as do Fall River and New Bedford. There are scattered areas of decline elsewhere in the state, but these five stand out conspicuously in eastern Massachusetts where varying degrees of rise are the rule.

Another interesting feature shown by this map is that apparently the period of decline in western Massachusetts has reached an end. There are a few scattered towns in the Western Upland where decline still prevails, and there are a few on the "watershed" between Worcester and the Connecticut Valley, but most of these towns show a steady or rising population. It would appear that their period of violent readjustment has passed.

There is one factor not readily apparent on this map, perhaps because it is now no longer as significant as it was. The physiographic divisions of the State, discernible on Figures 2 and 4, are not in evidence on Figure 6. In contrast, the cities stand out, either because of their suburban rings of increase, or because they form islands of steady or waning population amidst general areas of increase. Similarly, some of the resort towns stand out on the 1920–1950 map as areas of increase. Clearly, the determining factors for the last 30 years have been economic not physiographic.

Conclusion

As a technique in studying areal differentiation, classification of units on the basis of semi-logarithmic curves has much to recommend it. It is a device which makes possible the presentation of suspected relationships in more specific form. For Massachusetts, it has served to express the relationship between population trends and place, the results of adjustment to changing conditions in terms of relative location. From this study it is evident that an analysis based on long-range curves must be studied in conjunction with one dealing with recent years in greater detail, for current developments, in their rapid and often contradictory forms, are producing sweeping changes. It is only in the reading of the one in the light of the other that a total picture emerges.

BOOK REVIEWS

Atlas Estadístico de Costa Rica. Sección de Cartografía y Divulgación, Dirección General de Estadística y Censos, Ministerio de Economía y Hacienda, San José, 1953. (In Spanish.) 114 pp.; maps, ills., diagrs., index. $3.50. 10¾ x 10¾ inches.

This atlas is a milestone in the assembly and publication of cartographic and statistical data on Latin America. It is the forerunner of a series of national atlases sponsored by the Organization of American States and intended eventually to cover Latin America. Cooperative effort is in evidence throughout the volume not only among many government offices in Costa Rica but also with the United States Bureau of the Census and other offices in the United States and elsewhere.

The usefulness of the atlas is manifold: for school reference in Costa Rica, for research reference in American and European university studies focussing on Costa Rica, for public or private agencies concerned with economic enterprise or social or regional planning in Costa Rica.

The contents include: introductory text and maps of Central America; a pair of large-scale folded maps, 1:800,000, of Costa Rica; text and maps of vegetation, climate, population, agriculture, industry, and individual cities; and text without maps of education, commerce, finance, and transportation.

Appreciation of the atlas requires mention of what it is not as well as of what it is. It provides a wealth of data for study, but does not provide a comprehensive, coherent view of Costa Rica, nor integration of the data presented. The fact that it is a cooperative effort gives assurance of proper authority in details and inspires confidence in each contribution, but leaves gaps between contributions and little or no synthesis. In a few cases a map and the accompanying text are by the same author and there is a welcome interrelationship: the map illustrating the text and the text interpreting the map. In other cases the two are separate and distinct: the map showing phenomena not mentioned in the text, and the text filled with data not shown on the map.

It is interesting to note how the same topic may be viewed in separate ways completely detached from each other, the one geographical and the other non-geographical, on the one hand areal distributions and associations to be interpreted and on the other hand statements, tables, and graphs without distributive quality and hardly subject to cartographic presentation. Both text and maps offer much material potentially valuable, but the full use of all this in understanding Costa Rica is a challenge even to trained scholars familiar with the country.

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Tunisia Today: Crisis in North Africa, by LEON LAITMAN. iv and 216 pp.; maps, glossary, bibliogr. The Citadel Press, New York, 1954. $4.00. 8¼ x 5½ inches.

The book has an introductory chapter on the natural regions of Tunisia and the inhabitants of the country. A portion on Moslems, Jews, and Europeans is brief but revealing. The main part of the work, however, is on Tunisian production of olives, wheat, barley, dates, and livestock. The agricultural methods employed, the contrast between French and Tunisian farms, sectional variations in farming, origins and recent trends in production, and credit and marketing policies are described for each crop.

Mining, the second industry of Tunisia, is also analyzed. Tunisia is an important producer of phosphates, and other minerals including iron, lead, zinc, and salt, but so far the transformation of mining products within the country is almost non-existent. The lack of mineral fuels restricts opportunity for other types of industry. Electric power has not been developed to the extent possible.

The flooding of Tunisia by foreign machine-made goods has had an adverse effect upon native handicrafts. Further mechanization of Tunisian crafts, it is feared, might increase the problem of unemployment; and competition with industrialized Europe is next to impossible. The crisis in the artisan trade is aggravated by a rapidly increasing population, abundant hand labor, and low purchasing power. The former Tunisian production of artistic, colorful silk articles, and of woolens, cottons, metal articles, leather goods, and pottery have declined to low levels.

Five maps are included in the volume. A small sketch shows the location of Tunisia in the Mediterranean World, and the other maps show population density; physical features;

precipitation and ways of life (sedentary, seminomadic, etc.); and mines, power plants, and railroads. The reviewer would have liked additional maps of agricultural products, etc., but perhaps these would have been beyond the scope and purpose of the study.

Mr. Laitman concludes that native agriculture cannot be improved enough to solve the problem of poor living conditions, but that the production of alfa grass (for export to Britain for the manufacture of high quality paper) might be expanded somewhat, as well as the processing of agricultural products. Other suggestions for increasing revenue and providing lasting benefits for the native Tunisians include the simultaneous development of mining and associated industries and, most important of all, a revision of government and economy to reduce the political and commercial advantages of the European over the native Moslem.

The viewpoint on almost every topic considered is that France has placed the native Tunisian at a disadvantage, has depressed his living conditions, and has made it impossible for him to progress. The thesis seems to be that French colonization on the better lands, government tariffs and marketing policies that favor Europeans over natives, the inability of the native Tunisians to obtain adequate capital or credit, the unfavorable position of Tunisian olive oil in competition with West African peanut oil, increasing native population on inadequate holdings of semi-arid land, the concentration of mines and agricultural processing plants in French hands, and similar factors have reduced the Tunisian to a miserable state and led to a crisis in which he is attempting to secure a readjustment of political power and economic benefits. The last portion of the book outlines the unsuccessful attempts the Tunisians have made to obtain independence, and the recent (1954) changes in the government of Tunisia.

Mr. Laitman has a thorough knowledge of the economic problems of the Tunisian and is very sympathetic toward his need for assistance. Logical explanations, supported by facts and statistics, are given for his present plight. The summaries on present production and native economy are excellent.

Mr. Laitman skillfully and carefully points out the failures of the French in Tunisia (and they have been many), but he also avoids saying anything in their favor. For example, he mentions the great increase in Tunisian population (it has more than doubled since the beginning of the French Protectorate in 1881) without stating that the increase is due to such factors as decreased infant mortality, improved sanitation and public health programs, free hospitalization for the poor, etc., all of which have been provided by the French. The book leaves the impression that all conditions are worse now than they were before the French arrived, which is decidedly a false picture. It is true that a large segment of the native Tunisian population still lives in misery and that substantial improvements are necessary along many lines, but to make no mention of the advances (however modest) that have been made in public education, sanitation, water supply for cities, and legal and court systems is to present less than the whole story. The apparent assumption that everything would be all right if it were not for French commercial policies and French repression of nationalistic movements is not justified. The reviewer suggests that Laitman's book and the official French views on the same topics be studied together; one often serves as an antidote for the other. Both are biased. A comparison of the two shows that each omits the items that are unfavorable to the cause and interprets certain statistics to give the desired impression.

A few feat res detract from the readability of the book. The organization or writing of the agricultural sections could have been improved to give clarity and avoid repetition. For example, it was pointed out many times that it is easy for the French farmers in Tunisia to secure bank loans but difficult for the Tunisians; in places the fact reappeared on almost every page. There are occasional examples of awkward structure or actual errors in grammar.

However, these editorial slips are not of major consequence and from the tone of the first few sections of the book one can anticipate that conclusions will tend to criticize the French and sympathize with the native. The book does shed considerable light on the state of agriculture, mining, and commercial methods; for these matters the book is probably the best source in English. In sum, it is a recent and scholarly work of great value to all who are interested in the cultural geography, agriculture, mineral industries, general economic development, or government of Tunisia.

BENJAMIN E. THOMAS

University of California, Los Angeles

World Atlas of Population Distribution: Distribution of the Population of the World About the Year 1950. Edited by Dr. Friedrich Burgdörfer. 26 pp. of text and tables and 5 folded maps. Falk-Verlag, Hamburg, 1954. DM 40. 19 x 15 inches.

This, I believe, is the first published atlas, exclusively in the field of population geography, and as such it is particularly noteworthy.

The editor is a statistician rather than a geographer, a fact which is suggested by certain features of the content and the format of the publication. Although the title indicates a coverage of the entire earth, in reality only Europe, Africa and the United States are in-

cluded. An attached note indicates that additional sections covering Asia, Australia, North America, South America, and the world as a whole will be forthcoming. Text and map legends appear in both German and English with the English text in somewhat abbreviated form.

The *World Atlas of Population* is one part of a more extensive project described as a *World Atlas of Epidemic Diseases*, to be published in three volumes. The larger work is under the general direction of the Geomedical Research Division of the Academy of Sciences at Heidelberg University. The preparation of the manuscript and the printing of this atlas were sponsored by the United States Navy, Bureau of Medicine and Surgery.

Two principal parts comprise the population atlas: (1) twenty-six pages of text and tables, (2) followed by five large regional population maps, folded, and in color. The extensive tables contain data on population numbers and densities for the earth's continents and countries and for the states of the United States. The text proper describes the methods used in constructing each of the principal population maps, lists the source materials employed, and analyzes briefly the significant facts of population distribution.

The five large folded maps cover the following areas: Europe, 1:10,000,000; Central Europe, 1:2,500,000; the Mediterranean Area, 1:5,000,000; Africa, 1:20,000,000, the United States, 1:7,500,000. All five plates are in color, with population represented by colored dots or discs of graded sizes superimposed on a base in which elevations are shown in five shades of blue and tan. The colors used are most pleasing so that the maps have an unusually attractive appearance. On the backs of the colored plates are additional smaller maps in black and white. These include very crude population density maps of Europe, Africa, and the United States; index maps of the same three areas; and population distribution maps, using dot symbols, for Egypt, South Africa, and the Guinea Lands of Africa. The density maps are particularly disappointing since the subdivisions used are countries in the case of Europe and Africa, and states in the United States.

Although the colored base maps used in the five principal plates are unusually pleasing in appearance, it is this reviewer's opinion that the colors of the base maps tend to obscure, rather than clarify, the facts of population distribution. Over extensive areas the background colors are so strong that they have the effect of concealing the dots representing population. One has the impression that the five large plates are primarily relief maps and only secondarily population maps. In places, too, the cartographer has allowed himself to be unduly influenced by the terrain in locating the dots representing population. This error is especially noticeable in the map of the United States.

The graded dots and discs employed to show spread of population are actually spheres whose volume is proportional to the size of the population unit. In all but the smallest dot, the location of the symbol is precise, in that it coincides with a particular settlement. Because the dots are considered to be spheres, a serious injustice is done to urban population, especially the larger units. For example, the disc representing a city of 500,000 is by no means as visually impressive as 100 small dispersed dots each representing 5000 persons. This is an inherent weakness of employing volume symbols.

In summary, as a vehicle for representing population distribution, the maps in the atlas do not make the best use of either the space available, or of the amount of subsidy that must have been required to reproduce them. Attractive, and also expensive, as the colored plates certainly are, they are not effective as population maps. One would willingly dispense with some of the elegance in order to get a clearer representation of population features.

GLENN T. TREWARTHA

University of Wisconsin

This New World: The Civilization of Latin America, by WILLIAM LYTLE SCHURZ. xii and 429 pp.; maps, index. E. P. Dutton & Co., Inc., New York, 1954. $6.00. 8½ x 5½ inches.

This is the work of a mature scholar who has lived many years in Latin America, who is a keen observer of physical and cultural features, and who has a fascinating style. There is a summary chapter on the physical background, and then the author turns the spotlight on the characters who have acted out the Latin American drama.

Castile, the catalytic nucleus around which the other regions gradually coalesced to form Spain, had a habit of command and an imperial touch that early predestined her to leadership. Castilians set the pace in the Conquest which was "a thing of superlatives and the men who took part in it were supermen. For never have sheer human will and force of personality accomplished so much through the efforts of so few and on so vast a stage. The conquerors not only 'gave a new world to Castile and Leon'; their discoveries and conquests resulted in a world-wide economic and social revolution that radically changed the whole pattern of life in Europe and its overseas dependencies" (p. 112).

The irruption of the Spaniards spelled disaster for the Indians, "their natural leaders, led or seduced into the conquerors' camp by marriage or titles, and the shrines at which they had

worshiped overturned in the iconoclastic fury of the Christians, they became a thoroughly subdued and broken people. Sunk in apathy and melancholy, they were resigned to their fate as a subject race. Large numbers committed suicide rather than live under the alien domination. The Indians gradually drew within themselves and assumed the attitude of passive resistance that was to preserve important vestiges of their culture and their very racial identity to our times, particularly in the Peruvian Andes" (p. 53).

Modern Latin America is painstakingly interpreted in the light of cultural transfusions and graftings. The mighty Conquistadores by their enterprise won whole kingdoms for the Crown of Castile; in the white women when they were allowed to come to the new world, in the passive Indians of the *sierra* and in the high-strung impulsive Negro slaves of *tierra caliente*, they sired the Creoles, a frustrated lot who could never be judges, or governors, or viceroys. They in due time became implacably opposed to Spain and to Spanish hegemony in the New World.

The chapters on the role of the Negro and of the more modern foreigner in Latin America are especially penetrating. Both these elements have made substantial contributions to their countries, and few Latin American leaders question the net worth as ingredients in the national societies of the African and recent European contingents.

The author is not afraid to have an opinion and to speak his mind, and his ideas are couched in suave, unequivocal language. He concludes succinctly that "the Church must be flexible enough in its appeal to take care of the religious needs of all levels of the population—the students, who may consider themselves above the need of religion; the laborers, who are subject to the antireligious counterpropaganda of Leftist organizations; and the Indians, who have never really been Christianized and live in a half-world of faith and fancy" (p. 270).

It is a tribute to the erudition and competence of the author that he has been able to treat in such a few pages a subject so extensive spatially and chronologically. The volume abounds in eminently quotable passages, and it is felt that a review might fittingly end on the note sounded in the epilogue: "In making the most of what they have, whether it be much or little, their governments will have to display more wisdom in economic policies than they have in the past. In a world whose parts are still interdependent, they will have to forgo their dreams of autarchy, unless they are resigned to the fabrication of hermetical poorhouses of countries that do not have the makings of self-sufficiency. They are too ready to yield to the cry for economic nationalism and state socialism to indulge in five-year plans for the industrialization of economies that are basically primitive and extractive, in a defiance of whatever economic laws are still in force and in the acrobatics of a premature welfare state" (pp. 413–414).

RAYMOND E. CRIST

University of Florida

Post-War Agricultural Problems and Policies in India, by S. THIRUMALAI. xvi and 280 pp.; maps, diagrs., bibliogr., index. Institute of Pacific Relations, New York, 1954. $3.50. 9½ x 6 inches.

Mr. Thirumalai paints a grim picture of the status of agriculture in India today.

"Production is not commensurate with the minimum requirements of the population. The latter are in a permanent state of hunger and malnutrition. The various epidemic and endemic diseases have their work simplified by starvation. . . . The yields of crops have fallen and soil fertility has been stabilized at a low level . . . water, manure, and equipment are inadequate for maintaining the current production capacity. The methods of cultivation are primitive. There has been no significant advance in the application of technology to agriculture in spite of advances made in the science of agriculture within the country. . . . The incomes of the majority are unstable and below the margin necessary for their subsistence. There are no alternative or supplementary avenues of gainful employment." (pp. 255, 256.)

India, which is one of the oldest agricultural countries in the world and probably the center of domestication of a number of plant and animal species, has never fully emerged from the simple technology and economic organization of the subsistence type of farming. The British were responsible for introducing certain commercial crops, for alleviating famines and providing access to markets by means of railways and for extending irrigation. They were also indirectly responsible for the increase of farm tenancy. The decay of rural industries under British rule and the rapid growth of population have caused progressive increase in the dependence of population on agriculture and progressive decrease in the acreage of land available per capita. The question haunting India today is whether the worn-out land can support still more people on an adequate basis of nutrition and health.

In his factual and interpretative account, Mr. Thirumalai points out some of the ways of solving India's many agricultural problems. In his view, the essence of agricultural reform is the spontaneous inner urge among rural people for a higher level of living. If this inner drive can be harnessed to an economic system which increases the productivity of labor, both in agriculture and industry, India can perhaps disprove the gloomy predictions of Malthus.

The book is not a geography of Indian agri-

culture, but it is useful to geographers because it contains a concise statement of agricultural conditions since the partition of India. The statistics from as late as the crop season 1951–52 are set forth in numerous tables and incorporated into the text and are evidently the most recent available at the time of writing. Comparisons of trends during the first five years since the separation of Pakistan from India with the previous conditions are facilitated by tabulations of data for the territory which became the Indian Union as well as that which later became Pakistan. Comprehensive coverage is given to almost all aspects of agriculture: crops and crop yields, soil fertility and crop rotation, land use and land tenure, prices and agricultural finance, and various other technological or economic aspects.

Perhaps it is because the author has taken literally the meaning of the word agriculture (*ager* = field + *cultura* = cultivation) that livestock are almost completely left out of consideration. This omission is in part due to the deficiency of livestock statistics, which are not collected annually because livestock do not enter into the land revenue system. But the treatment of India's agricultural economy without reference to the ubiquitous cattle and goats, or various other farm animals, except to mention the existence of grazing land, the competing uses of manure for fuel and fertilizer, and the export of hides, wool, etc., seems inexcusable. India has one of the world's greatest concentrations of cattle, both zebus and water buffaloes, and supports vast numbers of goats. Interrelationships between livestock and crop production are not as close, however, as in European or Anglo-American agriculture. The share of animal products in the diet is relatively less than in Western countries. Yet milk and butter enter the diet of all economic classes and religious groups, and meat is consumed by nearly all who can afford it except orthodox Hindus. The problems of improving the quality of livestock, securing better feed and pasturage, and raising the level of dairy production and consumption are at least as important as problems of increasing the acreage under irrigation and adoption of better systems of land tenure.

The crux of India's food shortage is the low yield of crops. This is another point not sufficiently emphasized by Mr. Thirumalai. The yield is one of the important staples, rice, is about the world's lowest—one-third of Japan's rice yield per acre and one-half of China's probable yield of rice. Most other food grains such as wheat, barley, great millet (sorghum), bulrush or spiked millet (*Pennisetum typhoideum*), and finger millet (*Eleusine corocana*) have comparably low yields in India. This is largely the result of uncontrolled water supply, inadequate fertilization, improper crop rotation, and unimproved seed varieties. The low frequency of double-cropping, the high percentage of fallow, and the generally low intensity of cultivation cannot fail to impress anyone acquainted with agriculture in China or Japan. What is not generally realized is that India's ratio of 0.88 acre of arable land per capita exceeds the ratio of Italy and of most of the industrialized countries in northwestern Europe. India's ratio of arable land per capita exceeds China's ratio nearly two times and Japan's six times. If the intensity of agriculture in India could be raised to a par with that of China, or still better with Japan, the food problem would be solved at least for a generation or two. The recent adoption of Japanese rice production methods by a few farmers in Bombay state assumes unusual significance in the light of these circumstances.

Mr. Thirumalai is Research Officer of the Indian Society of Agricultural Economics with headquarters in Bombay. The book was published by the Society in cooperation with the Institute of Pacific Relations in New York. The printing and binding are especially attractive. The graphs and maps are reproduced clearly on glossy paper, although something is left to be desired in cartographic accuracy, e.g., swamplands appearing over the whole Rajasthan desert.

JOHN E. BRUSH

Rutgers University

Hungry People and Empty Lands: An Essay on Population Problems and International Tensions, by S. CHANDRASEKHAR. 306 pp.; maps, charts, bibliogr., index. George Allen & Unwin Ltd., London, 1954. $4.25. 8¾ x 5½ inches.

Dr. Chandrasekhar is professor of economics at the University of Baroda. His book discusses the problem of population and land and the importance of maladjustments between people and land with regard to international conflict. The book is important because it is written by an Indian scholar who sees the current world difficulties from a slightly different angle from that of Western writers. Surely no one should have more opportunity to study the population problem at first hand than an educated Indian.

The main part of the book is divided into six chapters. First there is an introduction. The other five chapters deal with: (1) the demographic cycle; (2) the world demographic disequilibrium; (3) the demographic danger spots, which are identified as Japan, China, and India; (4) population and food supply; and (5) population and peace. In addition there are three appendices: (1) the race question; (2) the freedom to move; and (3) North Borneo wants Indian settlers.

The reaction of this reviewer to the book is mixed. There are parts which seemed utterly trivial. For example, the introduction would seem to have been written in a great hurry,

repeating, in a series of *non sequiturs*, all the clichés concerning population, birth control, and food supply with which the writing on this subject has been deluged. In this chapter there are many words and phrases charged with emotional overtones, such as the partial quotation from Josué de Castro, "Hunger has been chiefly created by the inhuman exploitation of colonial riches . . . so that the exploiting country can take too cheaply the raw materials its prosperous industrial economy requires." Such a quotation filled with pulse-raising adjectives sets a tone which is journalistic rather than scholarly, propagandistic rather than analytical. What a surprise, then, to find the other chapters of the book written in a quite different tone. The introduction might have the effect of keeping scholars from reading more (unless they had to review the book), but it might lure the partisan into reading some sober analysis.

Dr. Chandrasekhar's program has five parts: (1) the grant of political freedom to all colonial peoples; (2) the universal adoption of birth control; (3) planned international migration; (4) large scale and rapid industrialization; and (5) intensive agricultural development. The introduction simply asserts these steps toward the creation of a peaceful world. In the rest of the book the problems of putting these steps into action are given a hard look.

The author of the book is an economist. He is what might be termed an economic determinist in that he believes that population problems and the conflicts arising therefrom are primarily economic. He does not appear to give any room at all to the psychological aspects of conflict, or the attitudes that create conflict out of population problems. The idea that population pressure is a state of mind is given no consideration. Rather population pressure is measured by statistics. Food supply, actual and potential, is also measured by statistics of production or estimates of calory intake. The geographer looks in vain for any discussion of land quality as a factor in production. When the author writes about planned migrations he has in mind spreading the world's population more uniformly over the world. He does not go as far as the communist geographers who suggest that irregularities in the distribution of people are a bourgeois inheritance and ought to be wiped out; but he does accept the idea that concentrations of people should be smoothed over by moving into such empty places as parts of the East Indies, and parts of the Americas (including the United States). The idea that areas of great density are becoming denser and areas of thin population are becoming thinner is not accepted, or even discussed.

Of course the maps are terrible. When Dr. Chandrasekhar relates the distribution of population with food supply he is doing a piece of geographic analysis; but his use of geographic method is characteristically crude. Imagine showing the world distribution of diets on a Mercator projection! And what is more he apparently did not use this projection for propaganda purposes, for his areas of poor diet, being mostly in the low latitudes, are minimized. If a geographer should use statistics as inexpertly as this economist uses maps, the economists would howl with indignation. Furthermore, it is not only that the maps are inexcusably crude, but that the argument reveals no concept of the meaning of areal relations.

Nevertheless there is no doubt that hunger and frustration do produce discontent and do cause people to follow any demagogue who promises the easy way out. It is not to say that if you are good you will be happy, but rather if you are happy you will be good. This quotation from Bertrand Russell can be applied to the conduct of nations. Only, is happiness to be analyzed by economic statistics, or is it a psychological state?

PRESTON E. JAMES
Syracuse University

Tsing Hsien: A North China Rural Community, by SIDNEY D. GAMBLE. xxv and 472 pp.; map, charts, graphs, ills., tables, index. Institute of Pacific Relations, New York, 1954. $6.50. $9\frac{1}{4}$ x $6\frac{1}{2}$ inches.

This study of Ting Hsien (Ting District) may be regarded as a post-mortem in the sense that it presents the examination of a situation largely no longer existing. It differs from a post-mortem in that it is not directed toward finding the cause of demise. Perhaps it would be more correct to call it a historical dissection of rural community life. The situation described is more than 25 years old, and Communism then had hardly penetrated the consciousness of any of the people of this district.

On the other hand, the sociological studies made of Ting Hsien, in which the author of this book participated, had much influence in the early Nationalist rural reform movements and no doubt affected the early thinking of many who now work in the Communist regime.

Most of the present book is an analysis of statistical information gathered through questionnaires and interviews. Its value lies in two differing functions: one, as a source book of a tremendous variety of information concerning a representative North China community; two, as an intimate picture of the socio-politico-economic complex of Chinese village life, but a life no longer recognizable in this district of China.

These statistical studies cover such topics as government and education, agriculture, finance, business, and industry. The book is by no means limited to statistical analyses, however. Parts 5 and 6, together representing 138 pages, or almost a third of the text, describe recrea-

tional activities, festivals, customs, and religion in one section; and myths, legends, history, calamities, and geography in the other.

Though much of the subject matter is of considerable interest to a geographer as well as to the sociologist and others interested in China, the logic of the organization and the sequence of topics is hard to discover. The historical and geographical background, which logically should precede the discussion of the contemporary situation and provide the setting, occurs as an afterthought in the tail end of the book. On the other hand, a summary occurring as Chapter I starts out with a brief geographical and historical recapitulation of the last chapter. Part I on Family Studies seemingly would be more appropriately placed after the discussion of more generalized subjects such as government and education, agriculture, and economics. The chapter on Calamities should follow rather than immediately precede the chapter on Geography, since most of the calamities result from the geographical situation. Part 3 on Agriculture, including a chapter on wells and irrigation, also logically should follow rather than precede the chapter on Geography.

Notwithstanding this type of organizational deficiency, the content of the book is fascinating to one wishing an insight into the ways and workings of traditional rural Chinese society, and the situation in which it operated. Thus, we find that foot-binding was almost universal among the women over 40 years of age in the 515 families studied, but none of the girls under 13 had bound feet, showing "how a cultural pattern which in the past had successfully defied an imperial ban, had disappeared within 30 years." The amount of land farmed by the family appears to have had a definite influence on both the number and proportion of children in a family. Rural diet by weight here was 40 per cent sweet potatoes, 31 per cent vegetables, 28 per cent grains, and 1 per cent condiments, meat, fruit, and miscellaneous.

The number of tax *mu* (area of land) on the 1929 tax roll in Ting Hsien had not changed since 1657, except for some land destroyed by flood in the 19th century and removed from the tax rolls. Industry in this farm community employed one in five of the total population and one in three of those over 14 years of age. The chief machines, human or animal operated, were the stone flour mill, the cotton gin, the cotton batting machine, the spinning wheel, the loom, and the Persian wheel for irrigation.

Among the chief community recreations were open air theatricals called Yang Ke (Planting Songs). Money to pay for these was generally raised by assessing the entire village, usually according to the amount of farm land owned.

Between 1882 and 1928 there was a discontinuance of 76 per cent of the temples in the district, indicating much abandonment of traditional religions. Ting Hsien histories listed 145 calamities during 1821 years, and, incidentally, reveal the great age of human occupance and land use, as well as the continuous historical record of the area. For every century after 1500 A.D., more than 11 calamities were listed, or one or more in every ten years. In order of frequency they were floods, droughts, locusts, hail, earthquakes, and epidemics.

For the geographer, in addition to the miscellaneous facts of geographical interest in other chapters, the last chapter is especially valuable. The climatic description applies to a much larger area than Ting Hsien. Actually, the meteorological data is from adjacent Pao-ting District. In this too brief chapter are accounts of floods, arable land, population, transportation, and communication. There is even a story of the effect of superstition on road development.

Neither at the ends of the chapters nor at the end of the book are general conclusions presented. The book essentially is an encyclopedia or miscellany of Ting Hsien with a sociological emphasis. It is a valuable contribution as such. The last paragraph of Chapter I, entitled "Summary," concludes with a disconnected local proverb in a manner which characterizes the organization of the material as a whole:

"Don't blame heaven if you haven't
Dug your cabbages before the winter solstice;
Don't be sorry for yourself if you haven't
Protected your onions before the coming of the first frost."

HEROLD J. WIENS

Yale University

The Mormon Village: A Pattern and Technique of Land Settlement, by LOWRY NELSON. xvii and 296 pp.; maps, diagrams, tables, ills., bibliogr., index. Published by the University of Utah Press, Salt Lake City, Utah, 1952. $5.00. 9¼ x 6¼ inches.

The major impression *The Mormon Village* makes on the geographer is that of a settlement pattern which did not evolve in response to any part of the natural environment but was planned in detail well before the inhabitants came into the area. The curious fact is that the resulting villages succeeded both economically and socially in the mid-nineteenth century, and that many still exist.

Dr. Nelson is a rural sociologist. He has made a close-up study of religious outlook, social organization, and the effects of these interacting in six specific villages in their respective natural environments and economic locations. Though a geographer might have compared changes in social organization in much more varied locations and under other variables, this study has great "space interest" for the system of development that it does show. Three of the villages are in Utah and were studied

twice: before 1930 and in 1950; the other three are in southern Alberta, settled as offshoots from Utah, and were studied once, in 1930.

The author observes that in the United States and Canada, nucleated farm villages, as contrasted with scattered farmsteads, are the exception. The Mormons developed the former not because of fear of Indians, or the influence of the New England towns from which many came, nor to conserve water in the Great Basin. They deliberately chose this form in 1833, 14 years before arriving in Salt Lake City, for their City of Zion, western Missouri, and for frontier towns in Ohio and Illinois.

Their choice reflected four elements of early nineteenth century American life: nationalism or separatism (the sense of being a separate group destined to occupy a clearly-defined piece of earth transformed by themselves), millenialism (the belief in a rapidly approaching Second Coming for which the elect were to be "gathered" and ready in a Garden Spot), agrarianism (a feeling that the farmer was the mainstay of economic prosperity), and perfectionism (the doctrine that man and the world can be improved).

Added to these was a feature on which most of the other American utopian settlements generally foundered: economic egalitarianism based on a concept of early Christian communism. According to the Mormons, man was God's steward over the land, and all surplus beyond one's need was handed to the Church for use as the Church authorities saw fit. Land was leased without charge to Church members by the Bishops serving as God's agents. Within the village, each person received the same sized lot for his home, family garden, and orchard. Outside the village, each was given a piece of land for farming and farm buildings, as well as rights to the common pasture. It was this sense of economic sharing that set the village pattern and preserved it, because the Church was accepted as having power over both temporal and spiritual matters; in fact, the two were not separated, since each was part of the other. The resultant social solidarity was very strong, and in some communities still is.

Other factors that preserved the farm village in the West are given by Dr. Nelson as: the arid climate that forced cooperation in the use of water for irrigation, and the danger of Indian attack. To these one might also add: remoteness from metropolitan centers and from routeways bringing in "Gentiles," as well as economic opportunities elsewhere to drain off surplus population after the village land was all taken up.

Part of the author's purpose is to show how the pattern has changed and is changing. There have been several modifications from the original Plat of the City of Zion, laid out for frontier settlements in the Middle West and used so widely in the Great Basin oases. For example, in many of the towns and villages of Utah today one can see dilapidated barns as evidence of former dairying on the large house and garden plots within-the-walls. And today, where population is increasing and intensive farming permits, as in more humid northern Utah, farm owners are living outside the village, as well as selling home sites to others. As for the future, the author predicts that unless non-agricultural activities are developed to increase employment, in the drier extensive agricultural areas the original nucleated pattern will remain, with a steady export of young people. "Thus," he concludes, "Mormons in Utah have a mixture of settlement patterns . . . in various places, depending upon the environmental conditions which prevail."

When the difficulties of settlement in Utah a century ago are considered, one may well wonder if some kind of social solidarity, inspired and maintained by a theocracy, would not be a valuable element in any serious colonization effort even today.

THEODORE HERMAN

Seattle, Washington

Rehabilitation and Development of Agriculture, Forestry, and Fisheries in South Korea, a report prepared for the United Nations Korean Reconstruction Agency by a mission selected by the Food and Agriculture Organization of the United Nations. xviii and 428 pp.; maps, tables, charts, appendices. Columbia University Press, New York, 1954. $8.50. 10¼ x 7½ inches.

This is a technical report but has special value for persons interested in the economic geography of Korea, for it brings together in one volume a vast amount of data on the basic elements of Korean economy—agriculture, forestry, and fishing. The report was made for a special purpose: to recommend specific actions for the recovery of these phases of South Korean economy to be carried out by the Republic of Korea and the United Nations agencies. It is hoped that these actions will be taken—and soon—for the development of a viable economy in Korea is critical for the Free World, but it must be recognized that relatively little sound action has taken place since the appearance of the report for varied reasons.

Geographers will find many features of this report of interest. Numerous tables summarize the existing statistical data and wisely make note of the relative validity of the figures. (Section J, Agricultural Statistics, pages 305–312, emphasizes the point that under-reporting of agricultural production was common during the days of Japanese control and has continued to the present.) The different sections of the report were obviously written by different specialists; there is some overlapping of information. Geographical facts on topography and

climate, for example, are scattered through the text and are sometimes contradictory; it would have been a saving to have had one summary of this material. As a technical report, there is naturally a number of technical sections which the layman will probably skip. Much of the data was collected in Korea and from contemporary reports. Background material, particularly in Japanese publications, has seemingly not been used very greatly. Some of the problems which are discussed plagued the Japanese during their days of control; they published numerous studies and reports on these problems, but evidently these did not come to the attention of the mission. There is no bibliography, though scattered references are found in footnotes. The lack of an index is a deterrent to easy reference.

Knowing that few (if any) readers of ECONOMIC GEOGRAPHY will spend a long time pouring over this volume, I would like to emphasize three sections which are valuable or unique. Section A, Chapter II, Types of Farming in Korea (pages 45–57), employs a very useful device: summaries of three case studies of farming in the mountainous country, in the wider valleys, and in the "rice bowl." Data were gathered on the county level, in selected villages, and, particularly interesting, from selected farmers. There is in this section some fascinating detail on farm production, disposal of products, and the farming calendar. These case studies graphically note the influence of varying topographic conditions on Korean farming practices. The report notes (in another section, page 9) that topography "restricts the farm lands to approximately 23 per-cent of the total area" of South Korea and that the increasing pressure of population means that the density of population is roughly 4 persons per acre of arable land. Geography students could profit greatly by studying these brief but informative descriptions which bear out these general conclusions.

Section B, Chapter 1, on land use, and the following chapter on agricultural production (pages 73–91) are unfortunately very condensed but do provide considerable data in the form of tables on South Korea. The differences in land use patterns and agricultural production within South Korea are not presented adequately. It is pointed out that in 1949, 71.5 per cent of the population lived as farmers. In that same year the average size of the cultivated farms was just under 2 acres. About a third of the farmers cultivated less than one and a quarter acres, another third cultivated between 1.23 acres and 2.45 acres, and the remaining third cultivated more than 2.45 acres. One of the important conclusions which the report reaches is that rice acreage should be reduced and greater crop diversification should be fostered.

The need for agricultural cooperatives, particularly on the local level, is stressed in Section I, Cooperative Organizations (pages 279–303). This has some interesting suggestions, but recognizes the difficult realities which exist. It makes the point that "for centuries Korean farmers have realized the economic advantages of cooperation. This is proven by their formation of large numbers of small and somewhat primitive voluntary cooperative societies known as Kes." The report traces the developments during the period of Japanese control and the tumultuous post-1945 years. It recommends that the Korean government "encourage an extensive and economically sound development of cooperative activity."

The parts of the report dealing with forestry—stressing the need for conservation—and fisheries—emphasizing measures which would lead to increased production—follow patterns roughly similar to those used for the discussion of agriculture. The total series of recommendations call for large financial support from abroad and for some drastic internal changes. Neither of these prerequisites for success seem to be forthcoming, unfortunately. It will be tragic if the report only results in another "survey" on a dusty shelf; it deserves action.

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World Population and World Food Supplies, by SIR E. JOHN RUSSELL. 516 pp.; maps, ills., diagrs., tables, index. George Allen and Unwin, Ltd., London, 1954, distributed by Macmillan, New York City. $8.50. 9½ x 6½ inches.

This book has a promising title, an attractive jacket, and many handsome photographs depicting agricultural scenes throughout the world. The preface gives a provocative summary of past anxieties regarding world food supplies, beginning in 1798 with Malthus' famous *Essay* and ending with the recent warning of the Food and Agricultural Organization that since 1939 world food production has not kept pace with population growth (*Second World Food Survey*, F.A.O., Rome 1952). This is followed by the author's assurance that "I have dealt with the countries of most importance from the point of view of food production and consumption: those which must import, those which can export, and those using some method of organization which may be useful elsewhere . . ." and ". . . the picture that finally emerges is one of tempered optimism." Thus the author promises a great deal, and thus, perhaps, inevitably tempts one to seek omissions and to be dubious of many conclusions. However, much of what follows makes a solid contribution buttressed as it is by a life-time of research and travel concerned with agricultural questions.

Two valuable chapters are provided on the United Kingdom (II and III of 54 pages), with separate treatment, curiously, for North Ireland and for the Republic of Ireland but not for Scotland. These depict wartime and post-war changes, showing how the domestic contribution to the food supply was raised from a pre-war 30 per cent to 40 per cent, and maintained in spite of a rise in population from the pre-war 47 million to about 50 million in 1950, and a shrinkage of the area under crops and grass between 1936 and 1949 by nearly 900,000 acres. This was accomplished by trebling nitrogen and potassic fertilizer consumption, by increasing the number of tractors in use six-fold, and by direct subsidy for particular operations plus a much larger subsidy to maintain lower prices for the consumer. Then follows a chapter on "Northern Europe's Intensive Producers" (IV of 54 pages), illustrated by discussions of the agricultural economy and practices of the Netherlands, Denmark, Sweden, and Finland. Why each of these countries was selected and Germany was omitted is not adequately explained. Then follows a chapter on France, Spain, Portugal, Italy, Israel, and Egypt (V of 50 pages), to conclude the treatment of Europe and the Mediterranean, comprising more than one-third of the book, but omitting mention of the significant developments in collective farming in the Soviet orbit, and the revolutionary changes in Turkey.

Next there are three chapters on southern and central Africa (VI, VII, and VIII totalling 135 pages), providing especially valuable treatment of "White Man's Farming," disconcertingly followed by the trivial coverage of Northern Rhodesia with a half page, the Somali Lands with two paragraphs, Uganda with three pages, and Angola and French Equatorial Africa with one page each. Admitting that the unique character of these African areas gives them great interest, it is questionable whether nearly one-third of the book should have been devoted to experiences that have so little application outside these tropical highlands. Certainly these areas are not of major importance either as importers or exporters of food products. Of two chapters devoted to Asia (IX and X of 27 and 9 pages respectively), only the first, on India, including a section on Pakistan, provides reasonably adequate treatment. Here, properly, stress is given to the problem of keeping pace with population increases of more than 1 per cent per annum, in areas of dense settlement and subsistence agriculture, under difficult rainfall regimes, and with complex structures of land tenure. Little, however, is said about current government planning in India, nor the encouraging results. The next chapter is fantastically short, with only 5½ pages devoted to China, which has more than one-fifth of the world's population; slightly more than one page on Japan, despite the valuable lessons this country has to teach regarding rice culture; and 1½ pages on Indonesia, Burma, Malaya, and the remainder of the Far East, even though the major rice exporting countries of the world are in this area. Finally, the book has three scant chapters devoted to the United States and Canada, Australia and New Zealand, and several countries of South America (XI, XII, and XIII totalling 115 pages), hence utilizing 20 pages less for these great surplus food producing and exporting countries than was provided for southern and central Africa.

The individual author may rightly demand freedom to place the emphasis of his study where he pleases. There are, however, limits to this prerogative, and it does seem that this book lacks balance in the areas selected for discussion, and often in the scanty treatment given. More particularly, there is little excuse for the omission of the Soviet Union and its European satellites, and what amounts to the omission of China, Japan, Indonesia, Burma, Malaya, and other countries of the Far East, areas aggregating well over 1 billion inhabitants, or more than 40 per cent of the world's population.

The author provides valuable insight into the agricultural practices of individual countries, notably the United Kingdom, the Netherlands, Denmark, and South America. However, the principal contribution made is contained in the final chapter on "Trends in World Food Supplies." In this chapter is given the evidence for "tempered optimism" regarding the adequacy of world food supplies. This may be grouped under three headings: (1) the possibility of increasing acreage under cultivation (the means used in previous decades) by expansion into grazing lands and into the tropics (possible, but difficult and costly), by increasing irrigation, and by clearing and using more cold forest land—the author pointing out that such expansion probably will no more than keep abreast of acreage losses through soil erosion, urbanization, and other competing forms of land use; (2) the possibility of "intensifying output from land already used" (considered most hopeful and susceptible of producing increases of 100 per cent and even more) by bringing the advantages of large-scale operation to predominantly small-scale family-sized farm units by means of the buying and marketing cooperatives and related programs on the Danish model; and (3) the possibility of technological advance on a wide front, involving the synthetic production of sugars, fats, and proteins (perhaps by using fresh water algae), hydroponics, vegetable matter from the sea, and "conservation and more efficient use of water, the factor finally limiting food production."

It is regrettable that some of the cruel labor involved in preparing a book of this scope could not have been shared with a junior co-author. Proper attention might then have been given

to the Soviet Union and its European satellites, concerning which a not inconsiderable array of information is available; comprehensive treatment might have been attempted for China, Japan, Indonesia, Malaya, and Burma; and then a selected bibliography might have been provided. Notwithstanding these shortcomings, this book is worth its high purchase price.

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The Prospects for Communist China, by W. W. ROSTOW. xx and 379 pp.; appendices, bibliogr., index. Technology Press, Massachusetts Institute of Technology, and John Wiley & Sons, Inc., New York, 1954. $5.00. 9½ x 6 inches.

If anyone is under the impression that the Massachusetts Institute of Technology is merely a school for engineers, this study of recent Chinese history provides evidence to the contrary. Professor Rostow and his three collaborators are members of the Institute's Center for International Studies, and "The Prospects for Communist China" represents a major research contribution to our understanding of the present Far East.

There are many statistical tables and a detailed bibliography, but no maps except the end papers. The book attempts to answer these questions: What are the motives of the Chinese Communists? What are their current intentions? What problems do they confront? What are their prospects of success? Much of the book is devoted to Communist policy, economy, and Soviet relations, largely since 1949.

Geographers will be especially interested in the economic sections even though they lack regional orientation. Here is documented evidence with regard to agriculture, industry, and commerce, both before and after the revolution. Of particular interest is the great decline in trade with Great Britain, the United States, Japan, and Germany, and its replacement by only modest foreign trade with the Communist bloc. Thus, Rostow records "Close economic relations with the Soviet Union involve not only intimate trade ties but also joint stock companies, credits, and technical assistance. Three Sino-Soviet companies were organized: for civil aviation and for the exploitation of oil and nonferrous mineral resources in Sinkiang. Given their location and scale, these companies do not provide leverage over the Chinese economy as a whole equivalent to that exercised by joint companies in eastern Europe. The character of technical assistance also differs greatly from that suggested by the role of Soviet advisers in eastern Europe. All available evidence tends to indicate that Soviet advisers do not perform management or control functions in the Chinese setting."

On the basis of the M.I.T. studies, "the Chinese Communist economy on the eve of the Five Year Plan (1953) can be said to be at a stage of development roughly comparable to that of Meiji Japan and present day India—but much more underdeveloped than the Soviet economy on the eve of its First Five Year Plan in 1928." A table gives the comparative gross national product of these countries in billions of 1952 U.S. dollars as follows: China, $30 (1952); Japan, $2.20 (1878–82) and $22.60 (1936); India, $22; and the Soviet Union, $35 (1928) and $100 (1952). In per capita terms these read $60, $65 and $325, $60, and $24 and $49. "Regardless of whether a detailed Five Year Plan is in operation or not, there is every evidence of a determined, relentless, and massive effort to pursue a program of industrial expansion."

Rostow and his associates summarize Communist objectives as follows:

1. An increase in standards of welfare must, in general, be postponed; and the proportion of the budget to national income must be maintained (say, 30 per cent).

2. Given the complex nature of the industrial equipment required, a high and rising level of international trade must be sustained, and imports other than industrial raw materials, machinery, and military equipment must be minimized.

3. An increased volume of total agricultural output must be allocated to exports.

4. An increased volume of total agricultural output must be allocated to feeding expanding urban areas.

5. A very high proportion of industrial output must be reinvested in industry.

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